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In This Issue:

The Ophir Mining District, Utah
By F. M. Wichman

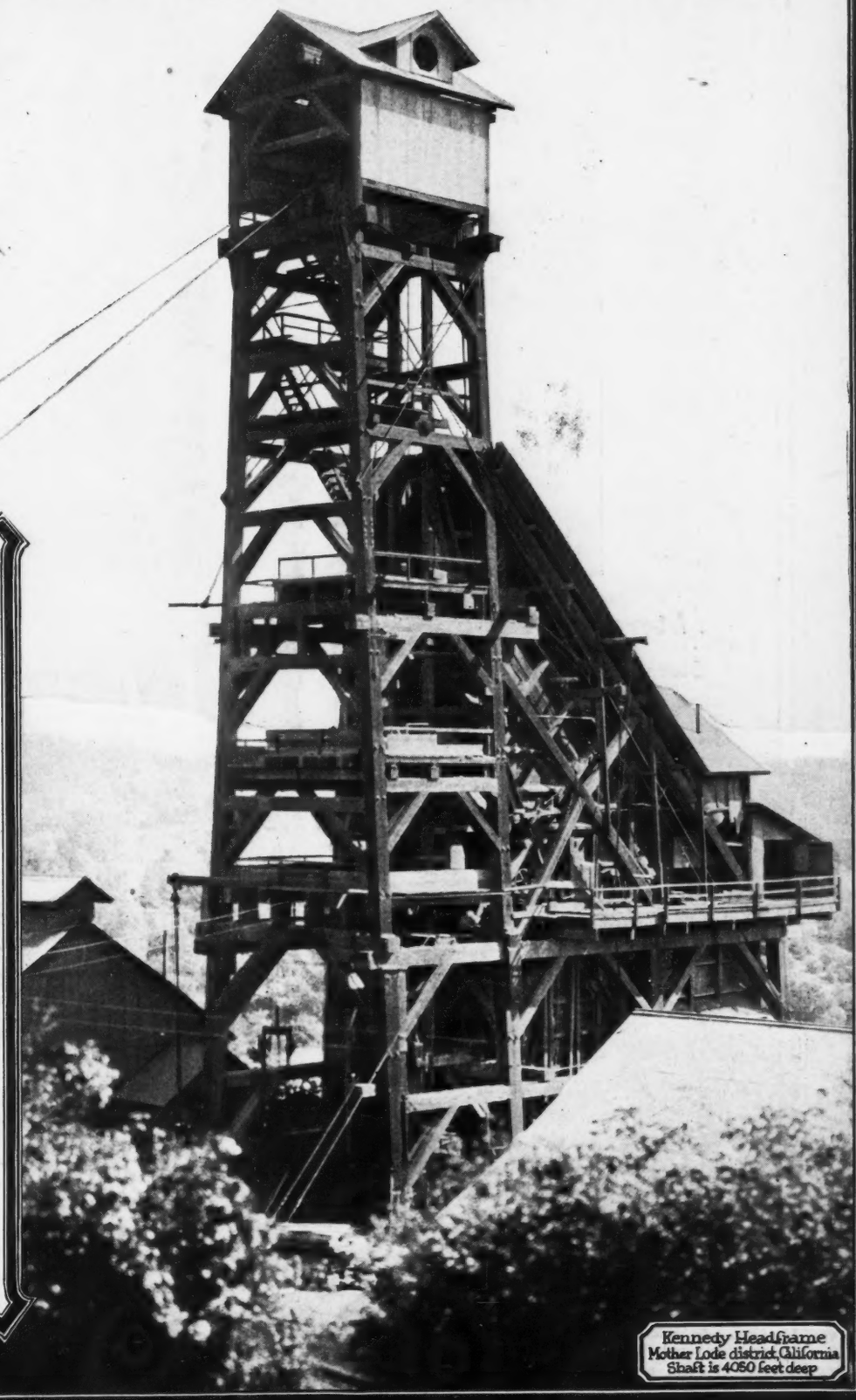
The Cost of Mining as Influenced by Poor Development
By A. G. Wolf

Selecting a Slag and Apportioning Slag Losses
By C. A. Grabill

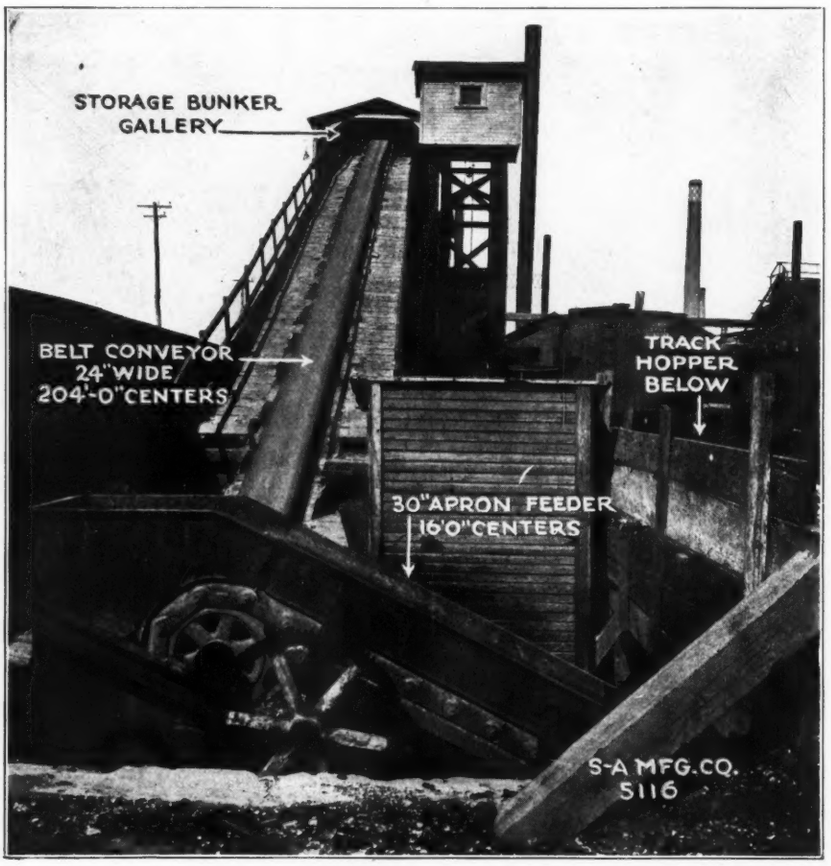
The Bear Facts
By Charles S. Haley

Biographical Sketch of Col. William Boyce Thompson

The Mining News



Kennedy Headframe
Mother Lode district, California
Shaft is 4050 feet deep



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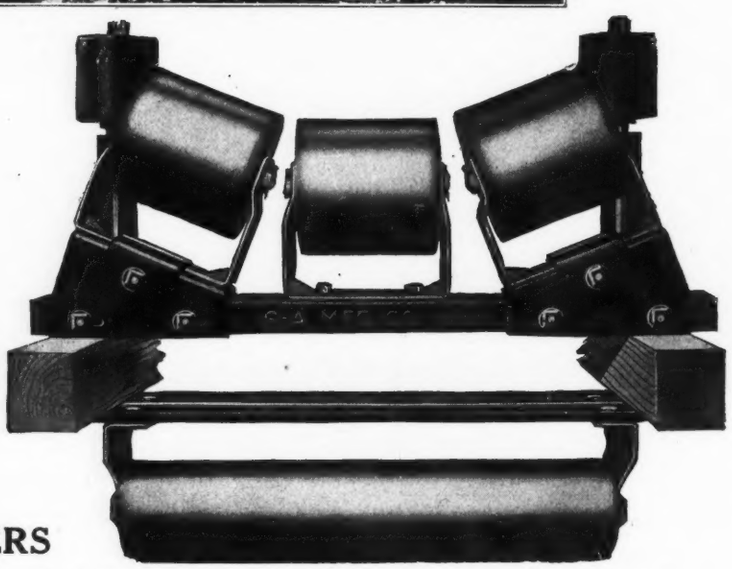

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Volume 110 **New York, September 18, 1920** *Number* 12

The Divining Rod

THE visions of the Middle Ages are with us still. We dream of transmuting base metal into gold, and of finding by some mystic power the ores from which the metals are extracted. The belief in the divining rod dates back to dim and obscure times, and will doubtless yet endure in some form for ages. Most prevalent is the belief in its ability to find water; but also the metals. From this in specific instances we progress to buried treasure; and a recent correspondent writes in of his ability to locate not only all these, but "animal bodies," and concealed whisky as well. A private still would have to be very still and private indeed to elude him, as he claims.

It would be a bold man who nowadays proclaims the impossible. We hesitate to begin, because we do not know where to stop. It may be possible some day for a man to jump to the moon, to see to the center of the earth; but we do not believe these things will ever happen. Similarly, we hesitate to proclaim the impossibility of locating water or ore by some hitherto undiscovered delicate process; but (speaking editorially) we do not believe that such a power or process exists.

The operator of the divining rod cuts a forked twig of willow, and grasps the two ends in his hands, with the point of juncture upward. As he walks over the ground at a certain place the stick turns over and its point designates the earth; and he cannot prevent its doing so, no matter how much strength he expends.

We once saw a demonstration of a similar rod for finding minerals, except that the rod was of metal, with a little box in each handle into which different metals might be slipped, according to the mineral to be detected. If gold was to be discovered, gold was slipped into the handles, and then the instrument pointed out the gold ore, in the manner indicated above. If nickel was the object, or petroleum, the insertion of the corresponding metal or mineral in the handles tuned the rod for a corresponding discovery. Armed with this instrument, the operator walked over a pasture, in Delaware, disturbing the peaceful cows, and located and plotted a broad gold lode; at right angles to this, and traversing it, a wide vein of nickel; and running in various other directions, tin, copper, and "petroleum" lodes. The operator was in earnest, and there is no question that his intensest efforts failed to hold the rod when it started to turn. Of course, the net result was humbug. There was nothing in the field. For others, the instrument failed to perform—it would not perform for the son of the operator. Plainly it would work for only certain personalities, who possessed the mysterious sensibility (which, the operator confided, had to do with the ultra-violet rays). And herein lies, in our opinion, the secret of the phenomenon. As for the rod, there is nothing whatever in it. It might as well be a rabbit's foot or a ball of crystal.

The manifestations noted are exclusively psychological, and analogous to those of the ouija writer, and they deal with natural but little understood nervous or mental laws. The writing on the ouija board, and the manipulation of the divining rod, are due to the subconscious impulses of the operator, which control and direct the muscles far more powerfully than can the relaxed conscious mentality. In the familiar phenomena of hypnotism, the hypnotist tells the subject that he cannot rise from his chair, and, exert himself as he will, he cannot do so—not because of the power of the hypnotist, but because of the dominant inhibition imposed by his own subconscious self. No hypnotist is necessary to induce this state.

An incident was related to us recently of a Mexican boy who was accustomed to light dynamite sticks and throw them for amusement. One day he could not let go his lighted stick; and could only push his hand as far away from his body as possible before the explosion which blew off his hand. Many further illustrations of this state, when the will is unable to combat the suggestions or fears of the subconscious mentality, might be cited. The subconscious mentality is ordinarily an indispensable part of our equipment: invisible to ourselves and without a speaking acquaintanceship with our conscious mentality, it does much of our mental work for us. Does a name escape you? Do not worry about it. Forget it, and presently the faithful subconscious mind will hunt it out among the archives of your memory and fetch it to you. Is a problem perplexing? Do not decide it tonight. Sleep on it, and in the night your subconscious mind will rake over and sift out the problem, and have the best solution ready for you when you wake in the morning.

It is this subconscious mind that directs the muscles of the divining-rod performer, the ouija writer, and the sleep walker. It is a reasonable and logical-appearing part of our mentality, and its messages often appear intelligent and hence surprising, since they come from a source unknown and ignored by most; but it is really hardly, if any, wiser than the rest of us; indeed, by itself alone it becomes unhealthy. A man dominated unduly by his subconscious cerebration may become to all degrees unbalanced mentally: the nerve-taxing nature of divining-rod operation, ouija writing, sleep walking, psychic trance and other phenonoma of this state are well known. And in the end the subject can tell little or nothing that is not known before. The subconscious mind of an illiterate ouija operator will spell as badly as the conscious mentality; the spirit of the Indian maiden who takes possession of the New York medium will use Bowery idioms; and the subconscious mind of the divining-rod operator is controlled by his own delusion. In the case of the operator of the alleged wonder-working device cited above the delusion had been nursed by an unscrupulous assayer.

Community Problems In Mining Camps

IT IS surprising indeed how community problems have forced their attention on mine managements. In the case of the isolated mining community which had to be developed literally from the grassroots in order to provide living conditions, that the mine might be continuously operated, these problems have been presented to engineers and managers in such a form that they had to be solved. Throughout the history of mining operations there have been a goodly number of such cases. Fortunate is the mine which is so favorably situated that it can call upon a community already organized to supply its labor during the development stages and then during the larger-scale operation when greater numbers of workers are required. Even in such cases community conditions have sometimes reached a pass such that only by the strong and intelligent leadership of the mine management can conditions be righted. Beginning with a cook house and a few tents, there are all degrees of the mining camp up to a village of several hundred houses, with a school, hotel, and accompanying stores. As an example of a substantial and well-ordered kind we may mention Hammonton, Cal.

The extremes of opinion on the subject appear to be that, on the one hand, the mining company has no other obligations than those of affording employment under safe and hygienic conditions, and, on the other, that, in addition to these conditions, it must exercise a paternalistic oversight over all of the community, providing amusement, sanitation, and housing, and initiating and even paying for all of the inevitable charities and sociological activities that may be necessary.

We are not disposed to debate these extremes of opinion. Nor do we believe that any well-balanced formula can be worked out that will serve for all cases and be a guide for the harassed mine management. We do hold the view, however, that a mine management cannot afford not to be a part of whatever activity there is in a community looking toward better housing, better sanitation, better living, and more wholesome amusement. This is an obligation which rests upon every individual in the community as well as upon the individual manager and the various members of his executive staff.

Looking back over two decades of mining progress, anyone familiar with the facts will conclude that there has been a great improvement not only in working and safety conditions about mines and reduction plants but about mining communities as well. One has only to spend a few days in Grass Valley, Cal., or Kellogg, Idaho, or some other camp which has become established upon a producing basis, to realize that "times have changed," and for the better.

As in so many other things, it is organized effort intelligently directed which accomplishes most for the mining community. Just how far this effort can go or is willing to go is of considerable interest. A recent example comes from South Africa. A company embracing the head office of the principal mining companies and affiliated organizations, employees and others, to the number of 800, has been organized as the Rand Co-operative Stores, Ltd., for the purpose, primarily, of reducing living costs. The co-operative trading organization is not new; it has been tried out successfully in England. With good leadership and wise restraint upon the part of the members, success should attend its efforts.

In a statement of objectives of the company, the following paragraph is worth noting:

> To form and establish pension funds for employees and to promote and establish institutions, clubs, or societies, and to erect, lay out, plant, and maintain buildings, grounds, fences, and ornamental gardens with the object of providing pensions for employees, recreation, and means of social intercourse for members of the company, their families and their relations, and the furnishing of any such institutions, clubs, societies, buildings, or grounds with furniture, fixtures, games, billiard tables, libraries, books, or any other matters or things conducive to the recreation and the social requirements or benefit of members.

This is a novel addenda to the co-operative trading plan. Its inclusion is a distinct expression of the need for such things in the average mining community, and of correcting the haphazard lack of method often characteristic of the mining camp or town.

We doubt whether conditions in many of our mining communities will admit of extensive introduction of co-operative trading, although experiments have been started in Tonopah, Nev., and Grass Valley, Cal., on modifications of this plan; but many of the purposes given in the interesting paragraph quoted are possible of attainment. Mining engineers and managers can serve a useful end, apart from their company duties, by stimulating initiative along similar lines in every mining camp.

Our 40 Per Cent Gold Cover Dollars

PROFESSOR WILLIAM E. CHANCELLOR, writing in *The Annalist*, discusses the danger in our Federal Reserve currency, which is secured by only 40 per cent of gold, and the rest by nothing tangible. As to the interchangeability of this currency and gold, he remarks aptly:

"I submit as certain that no ordinary bank depositor and customer would consider it judicious to ask his local bankers regularly to honor his checks in gold. He knows that were he to do so he would soon cease to enjoy banking credit. He would be considered erratic and annoying. Any banker would assume that such a customer was engaged in trying to build up a private gold hoard. Of course, an occasional request for a small amount of gold is granted at this time, though it was not granted a few weeks ago by ordinary banks.

"Now, this raises a very important question—whether or not we are even upon the gold standard in fact, whatever may be the case technically. Is this present currency anything more than a convenient counter? Have we not, without recognizing the fact, given up the gold basis and adopted the paper currency that the radicals have long been arguing for? And is not a large measure of our present social disturbance due essentially to the fact that we are trying to accustom ourselves to something as money that in fact is not money, but a mere concrete computing system?"

He concludes that,

"Money is a medium of circulation, and a system of storage units of value. Paper, even 40 per cent gold cover paper, whose gold we never see, is not money. A currency consisting entirely of the shoddy part of a wool-and-shoddy financial clothing cannot retain the confidence of any people long. Out in the open country, far from the centers of banking, most of the millions of Americans live; and these millions do in fact control the Government and the nation. Most of these millions know nothing of the Federal Reserve System beyond seeing this new and relatively powerless paper money. They are taking the two as synonymous, knowing

nothing and understanding nothing of the larger values of the system in delaying and perhaps ending panics, in moving crops, and in harmoniously co-ordinating the entire industrial, commerical, and other business life of the country."

According to Professor Chancellor's opinion, the remedy for the popular discontent over paper money is contained in the following suggestions:

"First. The replacement upon the counters of all banks, of gold to be taken at sight by bona fide depositors, as of old. Otherwise, the hoarding of gold by the great banks will start the hoarding of free gold as fast as possible by every citizen who can get and keep his hands on it; and America will become another India or China, with an insatiable appetite for real money, to be hidden.

"Second. The restoration to ordinary circulation of gold certificates.

"Third. The substitution for the small issues of Federal Reserve banknotes, of similar silver certificate issues in which the people have more confidence.

"Fourth. More candid and more frequent publicity through the Treasury Department respecting the exact amounts of all kinds of currency in actual circulation.

"Fifth. Deflation until we are so far away from 40 per cent gold cover and so near to the 100 per cent gold cover as to reassure the minds of all citizens."

It will be noted that the gist of this writer's pertinent recommendations is the restoration of gold as real money; and, moreover, leaning heavily, as an auxiliary support, on silver as real money; for he truly says that people have more confidence in silver certificates than in Federal Reserve notes, which, as we have previously stated, are 40 per cent gold value and 60 per cent I O U's.

Our financiers and bankers must not forget the fundamental fact that money is metal, under the century-tried system of the world; and that there is no other real and valuable money. Even the most stable government fails to sustain the fictitious stamped value of its paper money unless this really represents accessible metal. The protection and encouragement of the gold industry, then, becomes clearly a matter of great material importance; and it is clearly the duty of Congress to assist this by passing the McFadden bill. Furthermore, it is necessary to intensify the conception of silver as true money, and for this a fixed ratio of value with gold should be established in all countries, by a world-wide agreement, as it has been fixed temporarily in the United States by the Pittman Act. The passing of India to a so-called gold basis has resulted in hoarding of gold there, as well as silver, and further limits the basis of real money on which the world is doing its enormous paper business, and going bankrupt on its "easy-money" system.

Vocational Training for Injured Workers

LITTLE note apparently has been taken of the bill providing for the vocational rehabilitation of workers injured in industry, which became law on June 2, when it received the President's signature. The seeming lack of public interest in it probably is because its purpose has been confounded with vocational training of disabled soldiers. By the provisions of this new bill, the expense of restoring to vocational usefulness those injured in industry or any legitimate pursuit is to be divided between the state and Federal governments.

This marks a new step forward. Workmen's compensation legislation is not sufficient. It compensates, to greater or less extent, the injured worker for his injury, but it may leave him incapable of producing further at his regular occupation. The necessary funds for the work have been provided. An appropriation of $750,000 for the current fiscal year, and of $1,000,000 for each of the three succeeding years, is to be divided among the states on a basis of population, no one state to receive less than $5,000 per year. Each state must contribute an amount equal to that which it receives and must submit its plans, its courses of study, and the qualifications of teachers and other officers employed, to the Federal Board for Vocational Education for the latter's approval. It must also report how its money is expended. Civil employees of the Federal Government disabled in the course of duty are to enjoy the benefit of the act.

The workman is told to produce and keep on producing; that thus only can reconstruction be achieved. It is not strange, then, though some will say it is paternal, that the Government should seek to render the incapacitated workman productive. Instead, it is quite logical. The principle is sound and thoroughly up to date. But the saying "Once stung, twice shy" is apt. "Vocational training" has recently come to have a disreputable significance through the maladministration of the work among injured soldiers. It will take time for the public to forget this. The popularity of the new statute will depend largely on the manner in which the work is conducted.

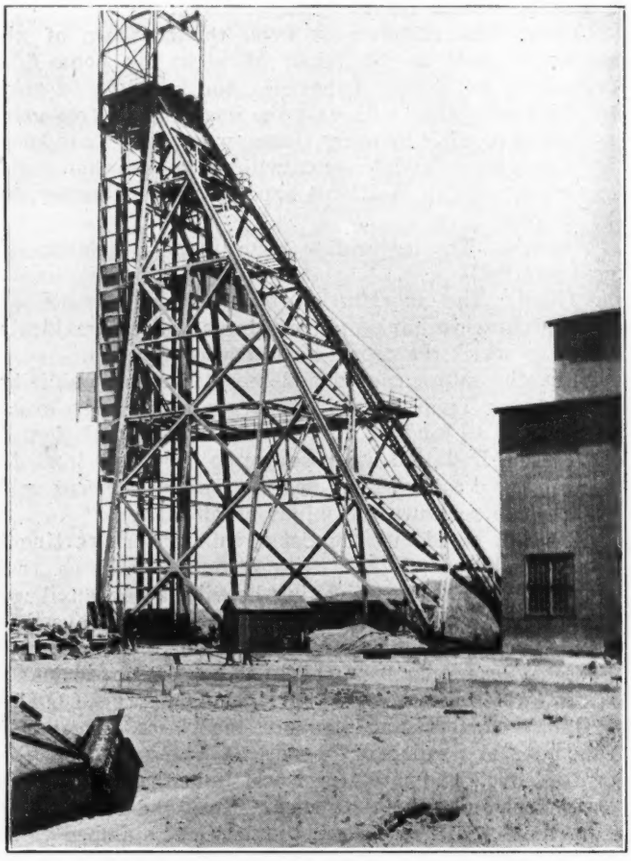
The Housing Shortage

THOSE who live in mining communities have one advantage over the populace of our cities, especially over those unfortunates who do not own their own homes. Most mining towns have at least enough houses to go around, even though they are not always everything that might be desired in luxuriousness. In many company towns, particularly, suitable and sufficient houses have been provided. Furthermore, the rents charged are often nominal, and in practically all cases considerably less than profiteering landlords are exacting in more populous centers. They are also fairly constant and permanent, and the lessee need not fear an advance whenever the owner feels that the time is ripe; or that he may be evicted on the fatal first of October. Often, electric power is supplied at a nominal figure and sometimes other benefits are derived which are not included in the ordinary lease.

The housing situation is acute in almost all of our cities, so that residents of mining communities would be wise to consider this fact before deciding to move. If one wishes to buy, the price asked is about three times the pre-war cost and the risk of a rapidly depreciating investment must be assumed. To rent or lease is almost impossible. Only last week a friend wrote us that he had rented the last house in Detroit. Here in New York we recently heard this story: After trying in vain for months to get a house, Brown wandered to the river, possibly with the thought of ending it all. Suddenly he heard a splash and saw his friend Green struggling hopelessly in the water. Without attempting to save him, he rushed off to his house agent. "Quick!" he gasped; "Green has fallen in the river. Can I have his house?" "Sorry," said the agent, "I've already let it to the man who pushed him in."

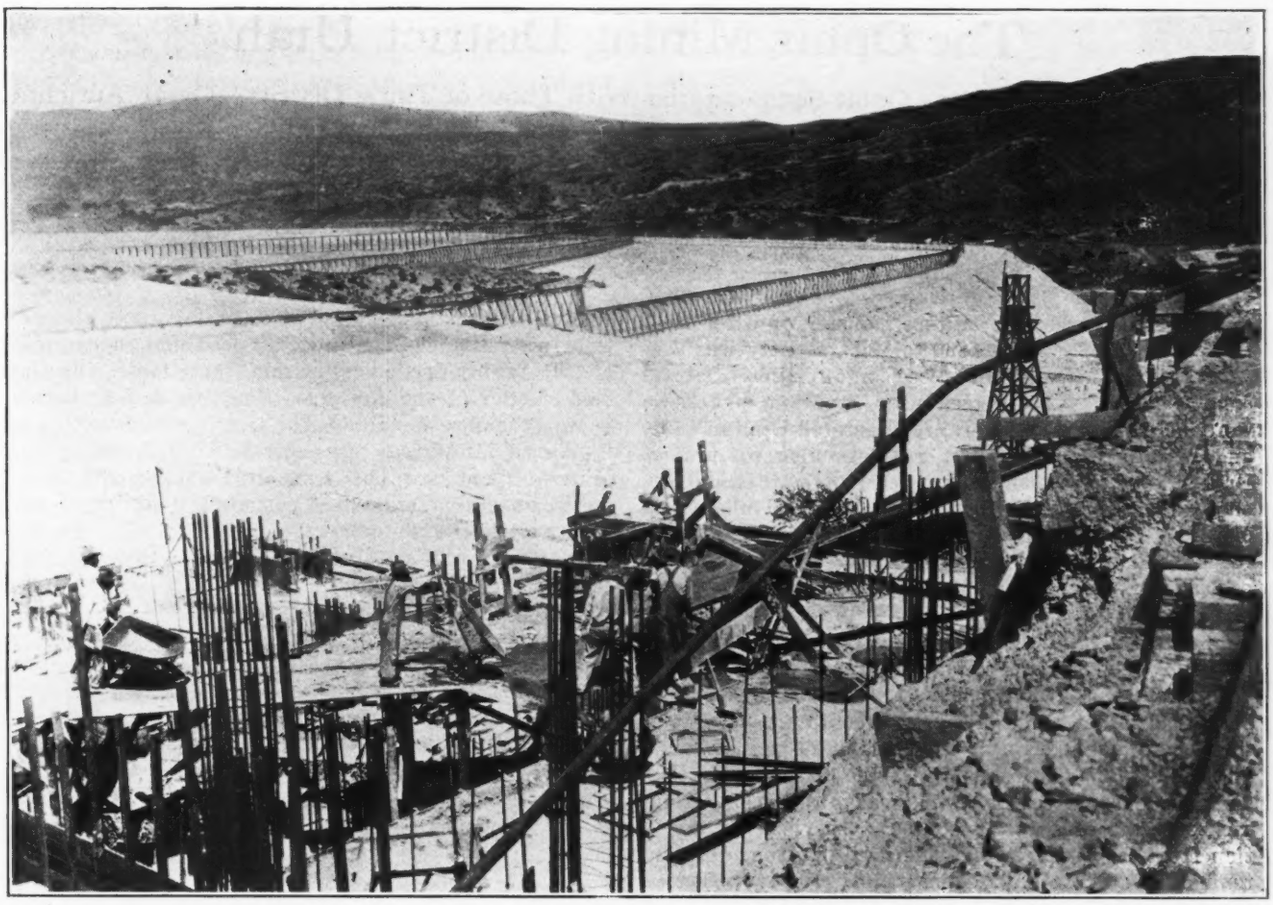
Miami Copper Plant, Miami, Ariz.

HEADFRAME AT PRESENT WORKING SHAFT

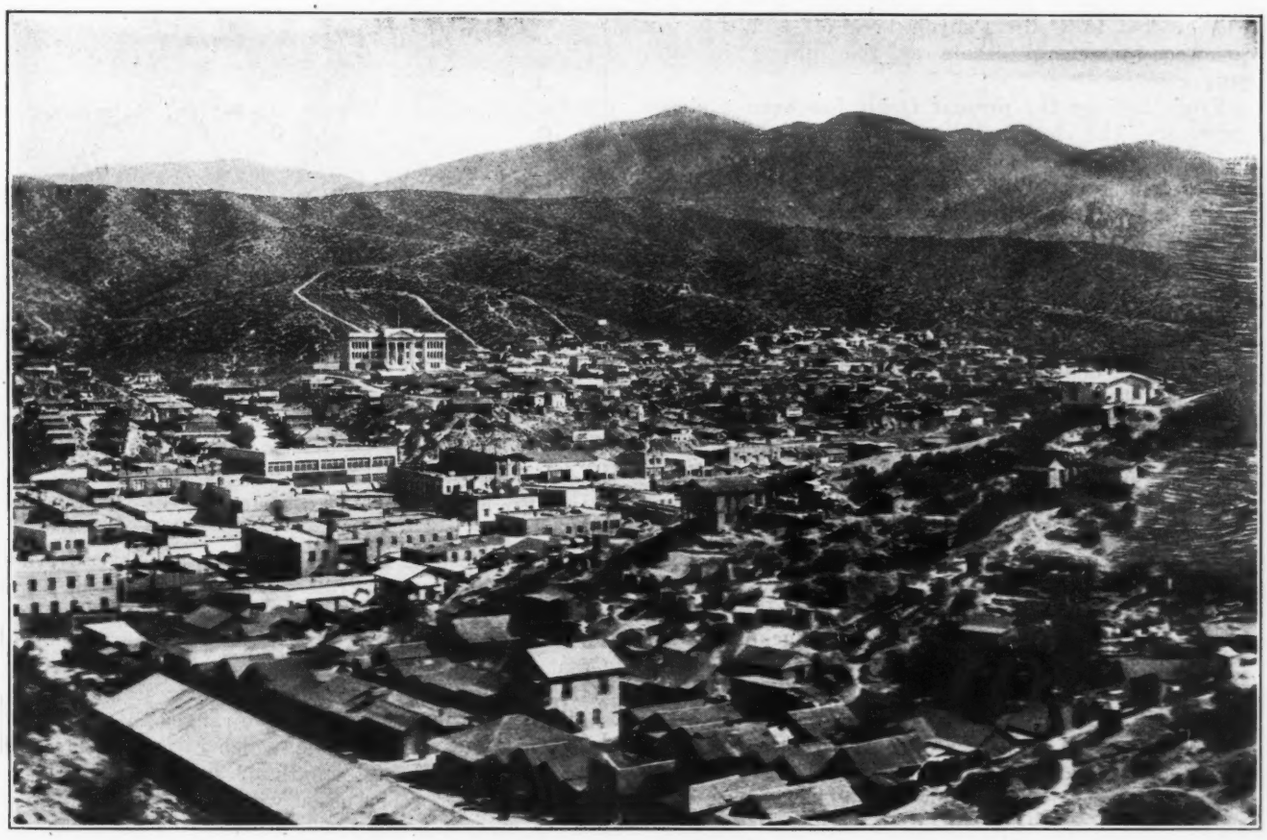


HEADFRAME AT NEW SHAFT

MINE AND MILLING PLANT OF MIAMI COPPER CO.



NEW CONSTRUCTION BY MIAMI COPPER CO. FOUNDATIONS FOR ORE CRUSHER PLANT AT NEW SHAFT. TAILING PILES ARE SHOWN IN BACKGROUND



VIEW OF MIAMI, ARIZ.

The Ophir Mining District, Utah

An Attempt To Correlate Ophir Sedimentaries With Those of Tintic District—Great Anticline, In Which Chief Ore Deposits Occur, and Ophir Fault Principal Geological Features—Locality a Steady Producer Since 1870

By F. M. Wichman
Mining Engineer, Salt Lake City, Utah
Written for *Engineering and Mining Journal*

THE history of the mining industry of Utah dates from 1863. From 1863 to 1869, activity was confined principally to the location of claims. Several small smelters were erected near Stockton, but these were not successful. The railroad entered Utah in 1869, and with it came the first real stimulus to mining. Branch lines were soon constructed from Salt Lake City, one south through the Salt Lake and Utah valleys and one west and southwest into Tooele Valley. The latter reached the Stockton district and immediately encouraged active development of the mines of Stockton and Ophir.

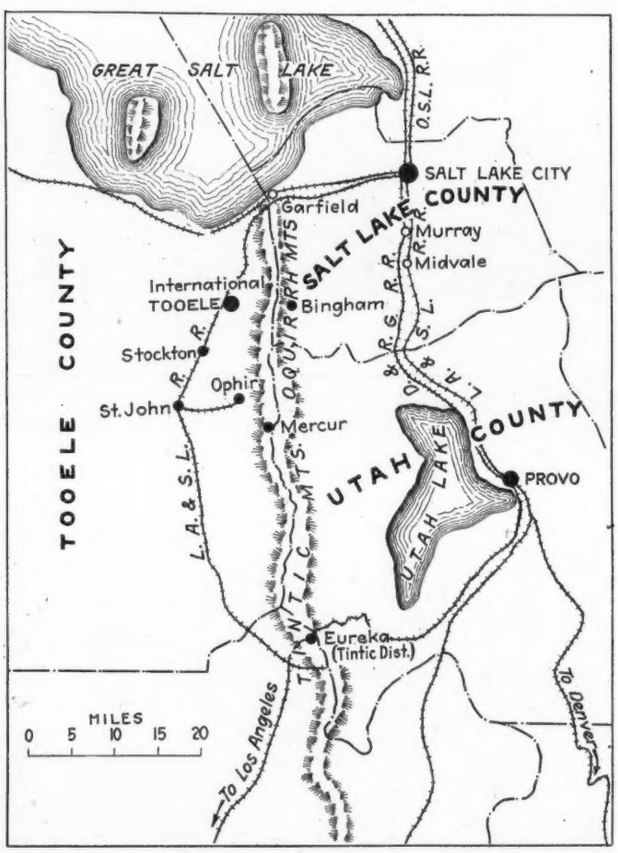
The Ophir mining district is situated on the west slope of the Oquirrh Mountains in Tooele County, eighteen miles south of Tooele City, the county seat, and fifty-seven miles by highway in a southwesterly direction from Salt Lake City. The first claim located in the district was the Silveropolis in 1870. As Ophir is but six miles from Stockton, it naturally followed that its rich outcrops of silver ores should receive early attention from the prospectors. The first shipment of forty tons of ore from this claim is said to have netted $24,000. The silver was in the form of chloride or hornsilver, and the surface ores are reported to have carried as high as 6,000 oz. to the ton. A stamp mill was erected in Ophir Canyon in 1871, and this was followed by several others as the mining industry progressed.

From 1870 to the present Ophir has been a steady producer. The rich surface ores were soon exhausted, but systematic development by organized mining companies soon brought to view rich carbonates and sulphide of lead accompanied by a high silver content and a small quantity of gold. In later years other metals have been profitably mined, copper, zinc, and manganese, but the lead-silver ores have always been the main source of revenue.

The district is credited with a gross production of from $35,000,000 to $50,000,000. Accurate records are not available, however, and it is probable that the lower figure is nearer correct. One mine alone, the Ophir Hill Consolidated, reported to the State Board of Equalization gross proceeds for 1918 of $840,668. This property, owned principally by Senator W. A. Clark, of Montana, has been a steady producer for a quarter of a century, and its claims under individual ownership yielded much rich silver ore in the earlier days. Among other mines in the district which have been highly productive are the Montana-Ophir, Hidden Treasure, Buckhorn, Lion Hill, Chloride Point, Northern Light, Buffalo, Jim Fisk, Kearsage, Eureka-Ophir, and Queen of the Hills. During recent years, consolidations have taken place, and the active mines at present are the Ophir Hill Consolidated, Montana-Ophir, Ophir Metals, and Hidden Treasure, together with a few of the older mines under lease.

With regard to smelters, Ophir is favorably situated. The International Smelting Co.'s lead and copper plant is only twenty-five miles by rail from Ophir; the Garfield smelter of the American Smelting & Refining Co. is forty miles distant. The American Smelting & Refining Co.'s Murray plant and the U. S. Smelting Co.'s Midvale plant are but sixty-five and seventy miles, by rail. A fair freight rate permits the mining of comparatively low-grade ore.

The Oquirrh Mountains form the most easterly of the series of north and south ridges lying in the Great



MAP SHOWING RELATIVE LOCATION OF OPHIR DISTRICT, UTAH, WITH RESPECT TO SALT LAKE VALLEY

Basin area between the Wasatch and the Sierra-Nevada ranges. They are separated from the Wasatch, about twenty miles distant, by the Salt Lake and Utah valleys. The Oquirrh Range extends from the south end of Great Salt Lake southerly for a distance of thirty miles. Here it is separated from the Tintic Range to the south by a broad pass. If the two ranges are considered as sections of a single range, which in reality they are, they will have a total length of seventy miles. The Oquirrh Range proper has a width of five to ten miles and its highest peaks reach an elevation of 11,000 ft.,

only 1,000 ft. less than the highest peaks in the Wasatch Mountains.

The Ophir district, unlike the Bingham district fifteen miles north, has developed practically no underground water. The mines are almost dry even to a vertical depth of 1,000 ft. As no development has taken place immediately under the floor of the canyon, it remains to be seen whether or not this area will develop water, but it is noteworthy that in diamond drilling to a vertical depth of over 1,200 ft., the holes appeared to be dry throughout and even the water that was pumped into the holes seldom reappeared at the surface.

Ophir Canyon is on the west side of the Oquirrh Range about six miles from its southern extremity. The general course of the canyon is southwest. Its floor is narrow, in some places scarcely the width of the wagon road and railroad track combined; in other places it is several hundred feet wide.

Ophir Hill rises on the north side of the canyon to a height of 2,500 ft. above the town. The south slope of this hill has the form of a great amphitheater with a semi-circular rim near the top of almost vertical cliffs. On the south side of the canyon Lion Hill rises as a great dome, nearly 2,000 ft. high. The north face of

LION HILL, OPHIR, UTAH

Lion Hill is very steep, owing to a series of vertical limestone cliffs 30 to 100 ft. high.

The Oquirrh Range is composed of Paleozoic quartzites, shales, and limestone, cut by stocks, dikes, and sills of various igneous rocks. The sedimentary rock has been subjected to intense folding and faulting. The average dip is northerly, but there are all variations from this, and it is difficult to follow any particular bed, even from one canyon to another. The limestones in some localities, notably in the Bingham district, have been considerably metamorphosed by contact with great masses of monzonite porphyry. In other localities, Ophir for example, much of the limestone is very pure. Other strata are either carbonaceous or dolomitic.

The rocks of the Ophir district consist almost entirely of limestone. The exceptions are two comparatively small exposures of Cambrian or pre-Cambrian quartzite on the south side of Ophir Canyon, several beds of shale at different horizons in the limestone, and a few intrusive dikes. The limestone consists of many varieties, ranging in color from white to black, in texture from very fine grain to very coarse grain; massive varieties, and thinly bedded varieties, beds of nearly pure calcium carbonate, and others running high in magnesium carbonate, but all differing materially in their paleontological character.

Unlike the Bingham district, Ophir exhibits only a scanty amount of igneous rock. Several narrow dikes, one of them outcropping prominently near the top of Ophir Hill, of a persilicic rock resembling rhyolite porphyry, and one narrow dike of subsilicic rock probably diabase, are the only intrusive rocks visible on Ophir Hill. The former stands nearly vertical and strikes north. It has no apparent genetic relationship to the orebodies. The basic dike follows one of the prominent northeast fissures and exhibits a small amount of ore along its walls. Owing to lack of development of this dike beyond a few shallow prospect holes, no conclusions can be reached as to the genetic relationship between the dike and the ore adjacent to it. Near the summit of Lion Hill, a broad dike accompanied by an intrusive sheet of porphyritic rock has caused a local silicification of the inclosing limestone. Some of the orebodies on Lion Hill are in this silicified zone, but they are likewise associated with northeast fissures. The basic dike noted on Ophir Hill crosses the canyon and is also found on Lion Hill.

The most striking geological feature of Ophir is the great anticlinal fold, which, on Lion Hill especially, is most remarkably developed. The axis of the anticline strikes N. 40 deg. W., and the two limbs dip to the northeast and southeast, respectively, in great sweeping curves. On Ophir Hill, the anticlinal axis dips at an average angle of 18 deg. to the northwest; on Lion Hill it is level for a short distance from the canyon, then gradually dips to the southeast. Thus, within an area two miles square, one may find dips in every direction, producing the structural feature called a quaquaversal fold. It is a noteworthy fact that nearly all the important mines of the Ophir district are on or close to the anticlinal axis. Folding has naturally caused considerable fracturing where the strain was greatest, but, as far as known, there are no deep-seated mineralized fissures conforming with the course of the axis; therefore, it is reasonable to conclude that the anticlinal axis, by virtue of its fractured and weakened condition, acted as a favorable receptacle for the deposition of ore brought to that region through other channels.

Only two unconformities of any importance exist in Ophir stratigraphy. One is at the contact of the quartzite and the overlying lime-shales and the other occurs at the top of the dolomite series. The former is the more interesting, inasmuch as it indicates that a long period of erosion occurred between the deposition of the quartzite and that of the shales. Before the latter were deposited, the quartzite had attained a very uneven surface. In some localities, the floors of the valleys were at least 300 ft. lower than the ridges. Consequently, as the shales were deposited, the valleys filled first, and some of the higher ridges still remained uncovered when the period of shale deposition gave place to that of the next higher formation. Owing to this uneven floor, there is a considerable variation in the thickness of the ore-bearing lime-shales.

Second in structural importance to the anticline is

the Ophir fault. This fault shows plainly near the base of Ophir Hill, and is the direct cause of the upthrow of that hill, exposing the Cambrian quartzite at the axis of the anticline. The fault strikes about N. 70 deg. E., and dips southerly at 65 to 70 deg. It is accompanied by several important and numerous unimportant sympathetic faults paralleling the main fault in a zone a thousand feet or more in width on either side. Until recently, it was thought that the displacement between Lion Hill and Ophir Hill was due to a single fault on which the displacement, represented by the difference in elevation between corresponding formations on the two hills, was 900 ft. However, recent diamond-drilling operations have proved the existence of other faults, and have shown that the maximum vertical displacement is nearer 1,700 ft., the most deeply faulted block being a narrow one, the top of which is completely covered by the gravel in the canyon. The fault can be traced for two miles in a westerly direction and nearly a mile to the east, but its point of maximum effect appears to be at the axis of the anticline.

Faulting Followed Ore Deposition

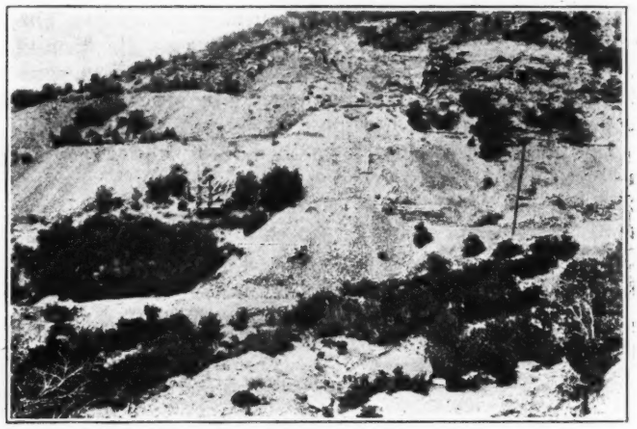
The consensus of opinion is that the entire fault system is post-mineral. The fault is unaccompanied by mineralization except in the vicinity of orebodies, and there it is much in the nature of drag ore. Diamond drilling by the Ophir Central Mines Co. on the south side of the canyon has proved the existence of ore deposits in the most deeply faulted block of ground in a lime-shale formation similar to that carrying ore on Ophir Hill, indicating that a continuity probably existed in the ore deposits under Ophir Hill and Lion Hill before the period of faulting.

The Ophir district is traversed by many northeast fissures. They strike from N. 20 deg. E. to N. 60 deg. E., and, with few exceptions, dip steeply west. A few of the important ones have yielded rich silver-lead ores, but in profitable quantity only where they cut certain limestone beds which have been more susceptible to replacement than other beds. These fissures are found at all depths, and are evidently the channels through which the metal-bearing solutions ascended. The typical gangue is calcite, although one prominent fissure has a quartz gangue. The fissures vary in width from a fraction of an inch in the hard formations to four or five feet in the softer ones. Faulting of considerable importance, in one case 200 ft., accompanies several of the fissures, though others show none whatever. In many places the gangue and ore of the fissures have been removed by the circulation of vadose waters, leaving open-air courses hundreds of feet in depth. Ore-bearing solutions passed from the fissures into the more "soluble" limestone beds, thus forming the bedded deposits which have been the source of 90 per cent of all the ore mined in this district.

Geology of District Given Scant Attention

The geological features of the Ophir district seem to have received scant attention from the U. S. Geological Survey. J. E. Spurr, in his valuable paper on the "Economic Geology of the Mercur Mining District," which appeared in the Sixteenth Annual Report of the U. S. Geological Survey, refers to the general geological features of the Ophir district. The Fortieth Parallel Survey, by Clarence King, also furnished some valuable information, but neither of these reports went into detail with regard to the various limestone formations. In recent years, greater importance has been attached to this phase of the subject in other mining districts, and the estimable report on the Tintic district by Lindgren and Loughlin, published a year ago, goes into great detail in this respect. These geologists have established a definite nomenclature to the more important formation represented in the Tintic district, comprising in the aggregate nearly 7,000 ft. of sedimentary rock.

In Ophir, however, no definite nomenclature has been established. The productive lime beds have been named after various mines and claims, but there seems to be a difference of opinion, even among local mining men, as to which is which. The "Henrietta limestone," for instance, is a name applied to a mass of limestone and shale having a stratigraphic thickness of 1,200 ft., and comprising several very distinct formations.



SURFACE WORKINGS IN OPHIR FORMATION, OPHIR, UTAH

A geologist engaged in the study of the various sedimentary beds exposed in the mountain ranges of the Great Basin area is constantly impressed with the importance of having an established nomenclature with which to work. Of course, one would not expect to find every formation that is represented in one district also represented in another district 100 miles away, but if, as a basis of nomenclature, the various horizons in one locality, where the stratigraphic column is complete and definitely fixed, were accepted, investigators would be materially aided in their work elsewhere.

For my own convenience, I have attempted to correlate the Ophir sedimentaries with those in Tintic, applying the same names to similar formations. On close examination, a striking similarity appears. However, in the mineralized district of Ophir, that is, on Ophir Hill and Lion Hill and in the adjacent canyons, only 3,000 ft. of the Tintic sedimentaries above the quartzite are represented.

The oldest formation represented in Ophir is what I shall call the Tintic quartzite, about 400 ft. of which is exposed on the foot-wall side of the Ophir fault near the base of Ophir Hill. It has been correlated as a Cambrian formation by some geologists, and by others pre-Cambrian. Metamorphism has destroyed all fossils that the original sands may have contained. The quartzite has been brought to the surface by faulting and is exposed in only two places; namely, in two gulches located approximately in the axis of the anticline.

Lying unconformably upon the quartzite is the Ophir formation, consisting of an alternating series of shale

and limestone beds. The lower shale members are quite siliceous, whereas those near the top grade into an argillaceous limestone. The shale has a greenish tint on fresh fracture, due to the development by dynamic metamorphism of epidote and other aluminum silicates. The thickness of this formation varies widely from the narrowest trace to 300 ft.

Five Ore Horizons in Ophir Formation

The Ophir formation has furnished the bulk of the ore which has come from this district. It contains five ore horizons, which have been mined to a depth, on the incline, of nearly 2,000 ft. The ore is associated with northeast fissures cutting the formation. The superficial ores were rich in silver, but in depth they are principally in the form of argentiferous galena associated with sphalerite, chalcopyrite, and pyrite. The ratio of silver to lead varies from one-half to one to one to one. Copper sulphide ore, largely chalcopyrite, of excellent grade, is also mined in one horizon. Secondary enrichment is not particularly noticeable below the surface. It is probably the secondary zone that now shows at the surface, erosion having removed the original leached zone. Both chalcopyrite and galena, apparently in primary form, are found close to the surface.

There is no clear line of demarcation between the Ophir formation and the Teutonic Limestone. In a section taken at the anticlinal axis, the Teutonic has a thickness of 665 ft. It is bluish-gray, fine grained, thinly bedded argillaceous limestone. It is not known to be ore-bearing, but is a very distinct formation and is persistent in many localities in western Utah.

The Dagmar limestone rests conformably upon the Teutonic. In the section above referred to, it has a thickness of 125 ft. It can be distinguished readily from all other formations by its oölitic beds, of which there are several, varying from 3 to 8 ft. in thickness. They alternate with beds of an argillaceous limestone.

The Herkimer limestone which overlies the Dagmar includes at its base about 12 to 18 ft. of shale. The bulk of the formation, however, is a thin-bedded argillaceous limestone. The shale contains secondary silicates, and in a few localities a little pyrite and chalcopyrite. It is an excellent horizon marker. The Herkimer has a total thickness of 268 ft.

The next higher formation is the Blue Bird dolomite. One can never fail to identify this rock, as it is entirely different from anything else appearing in Ophir. The characteristic rock is of a dark gray, medium-grained crystalline texture, but interbedded with it are several layers of nearly pure white dolomite, having a sugar-like texture. A section of the Blue Bird dolomite on the anticlinal axis exhibits a total thickness of 690 ft., about 160 ft. of which is the aggregate thickness of three white dolomite beds occurring in the upper half of the formation. The Cole Canyon dolomite of the Tintic district is not represented in Ophir.

Above the Blue Bird there is a bed, 200 ft. thick, of gray, crystalline dolomite, above which lies a bed, 90 ft. thick, of dolomite similar in texture but darker in color. It resembles the lower part of the Opex dolomite in Tintic, but lacks the shale members of that formation.

A slight unconformity exists at the top of the dolomite series. It is more noticeable on Lion Hill, especially when viewed from a distance, than on Ophir Hill. None of the dolomites has been found ore-bearing.

Overlying the dolomites at Ophir is an important limestone bed which is apparently not represented in Tintic. It is locally called the Buckhorn. It is a fine to medium-grained rock, is nearly pure limestone, and has been the source of considerable ore. The average thickness is 30 ft.

Above the Buckhorn in Ophir appears the lowest of the cherty limestones. In Tintic the lowest of this type is called the Ajax, but aside from the cherty inclusions there is no similarity between them. I am inclined to place this formation in Ophir much higher in the series, correlating it with the Gardner dolomite of Tintic. In the southern part of the Ophir district, there occur siliceous beds at the base of this formation quite comparable to the Victoria quartzite which underlies the Gardner in Tintic. The lower part of the Gardner on Ophir Hill consists of a bed of magnesian limestone, 90 to 100 ft. thick, dark bluish-gray when fresh, but weathering a dirty brown. Higher in the Gardner formation the limestone becomes more massive. Fossils, including large brachiopods, are common at some horizons. The total thickness of the Gardner in Ophir is somewhat over 500 ft.

Overlying the Gardner, but with no distinct boundary separating them, lies what is called in Ophir the Hidden Treasure limestone. It might be considered as the upper part of the Gardner, but, on account of its value as an ore-bearing medium, it is advisable to give it a distinct name. It forms the summit of Ophir Hill, and several beds within the formation have been very productive of high-grade ore. It is a coarsely crystalline, rather soft, light gray to brownish limestone. The formation contains interbedded layers of thin dark-colored limestone similar to that in the Gardner and at least one bed of dense carbonaceous shale. The last is usually considered to be the hanging wall of the orebodies. Fossils of Mississippian age are abundant. Of this formation, 75 to 150 ft. is all that remains at the top of Ophir Hill.

Ophir and Tintic Columns Compared

The comparison of the Tintic column in the Lindgren and Loughlin memoir and the Ophir column from the author's notes shows a remarkable similarity for the first 2,300 ft. above the quartzite. Above that horizon, however, the Tintic column contains over 2,300 ft. of sedimentaries which are not represented in the Ophir column. The missing strata would indicate that there was either no deposition at Ophir between Upper Cambrian and Lower Carboniferous or else a long period of erosion preceded the sediments of the Lower Carboniferous.

The Ophir formation offers the greatest field for future development, but the upper productive limestones are of too great importance to be overlooked. It is possible that other ore zones will be found to the east of the developed anticlinal zone, just as in Tintic ore has been developed in depth several miles to the east of the synclinal trough. In fact, the existence of at least one mine, the old Jim Fisk, which produced very rich silver ore in the early days, is indicative of the fact that orebodies occur on the east limb of the anticline, nearly a mile from its axis. The ore in this mine occurred in fissures where they traversed one of the Hidden Treasure beds, and typifies how important certain limestone horizons are in the deposition of ore. Development work in this mine shows that where the same fissures passed into the underlying stratum they are insignificant.

Tin a Much-Maligned Metal

Some Elementary Facts for the Man Who Does Not Know What a "Tin Can" or a "Tin Lizzie" Is Made Of

BY E. D. WARD
Written for *Engineering and Mining Journal*

OWING to the extremely loose use of the word there is probably no metal of which less is known by the man in the street than tin. Any metal container of food is referred to as a "tin" can, but the amount of actual tin in, say, "a tin" of sardines is about equal to a quarter of a dollar in weight. The "tin" popularly so-called is in reality made of thin sheet-iron coated with a solution of tin to prevent rust. "Tin" dishes and "tin" roofs are made of galvanized iron. Even the "tin" soldiers of our youth are made of lead. As a consequence of this mistaken nomenclature the word "tinny" has even been coined to signify a somewhat meretricious metal article.

Why tin should be maligned to this extent is difficult to understand: a "tin" can does not even closely resemble the metal whose name it has appropriated. Popular prejudice is admittedly a difficult matter to tilt against, but it is certainly due to a valuable and miscalled metal to give some account of its production and uses.

The chief tin-producing countries of the world are the Federated Malay States and the nearby Island of Banca, which annually export about one-half of the world's tin supply. Next in order come Bolivia and China, and among the smaller producing countries may be mentioned Siam, Nigeria, Australia and Great Britain. In the Federated Malay States tin is found as an ore in gravel, and all the workings are alluvial, with the exception of a few deep-cast mines. There are no underground workings. When the gravel has been washed thoroughly the resultant ore contains about 70 per cent pure tin, and the same percentage is, on the average, extracted when the ore is smelted, though exceptionally good lots may give 75 per cent or even higher.

Until comparatively recently the actual mining operations in the Federated Malay States were in the hands of the Chinese, the European merely acting as buyer of the ore. The primitive methods of washing adopted by the Chinaman naturally were wasteful. The mines are now gradually coming under British management, and are being worked and developed by more modern and scientific methods. In many places the old washings, or "tailings," as they are called, are being retreated for the recovery of the metal contained, with satisfactory results.

The actual mining of alluvial tin ore is simplicity itself. The ore-bearing gravel is mixed with water and led down a series of wooden troughs. In the bottom of these troughs are nailed slats of wood about an inch high. The ore, being heavier than the gravel, keeps to the bottom of the trough and is trapped by the slats, while the gravel is carried off by the water. The ore is then dried, placed in bags and sent off to be smelted. In some mines, particularly the more modern ones, the labor of digging the gravel is dispensed with by playing a powerful jet of water on to the face of the working, and guiding the wash thus obtained directly into the troughs.

Other minerals occur in tin ore, but rarely in sufficient quantities to be of commercial value: in fact, rather the reverse, for in that event the ore requires special treatment, such as roasting, to dispose of them. In this connection an illuminating story is told of a well-known smelting firm which before the war accidentally came into possession of a large quantity of wolfram ore. The firm reported the find to the British government and offered to sell at the market price of the day. The authorities loftily replied that they did not do business privately in that way and suggested that the ore be put up for public tender. It was, and was bought by a German firm at twice the market price!

At the smelting works the ore is mixed with anthracite and crushed slag and put through the furnaces. It is not possible to extract the full percentage of tin in one smelting, hence the addition of the slag—the residue of a previous smelting. When ready, the molten metal is run off into rough ingots, which are again smelted down in a refinery and ladled out into moulds for shipment, each block weighing about 130 lb.

If the metal containers of foodstuffs really were made of pure tin there would be reason indeed to complain of high prices. At present tin sells for about £269 per long ton; sheet iron for about £40. Tin plays a small but very important part in the composition of "tin" cans. It possesses the valuable property of being absolutely rustless and is therefore used as a barrier between the iron of which the container is made and the contents. When one thinks of the hundreds of millions of "tins" of bully beef, jam, pork and beans, M. & V. rations, and other necessaries and delicacies that were produced during the recent war it will be realized that tin "did its bit."

In the unenlightened past, before national economy became so essential, it was customary in Great Britain to throw away empty "tins," and special ships were employed to take large quantities out into the North Sea and dump them. Shortly before the war the Germans set up large foundries in England for dealing with this waste material. They perfected a process for recovering the actual tin, they melted off the solder and they pressed the iron into blocks, and then exported the whole lot to Germany! British enterprise is now at work, and the empty "tin" so carelessly thrown into the dustbin has by no means finished its usefulness.

Tin is also largely used in alloys. Stereos and type are composed of an alloy of tin, lead, and antimony. Pewter is an alloy of tin and lead, and most "white" metals usually have some proportion of tin in their composition.

As previously mentioned, tin is found in the British Isles, chiefly in Wales and Cornwall, but rarely in a free state, and its production is never likely to be a big commercial success in those districts, on account of the heavy working expenses. In the Federated Malay States, on the other hand, the industry has not yet been developed to anything like the fullest extent. In many places, particularly in the State of Perak, tin mining is superseding rubber planting. Labor is plentiful and cheap, the Chinaman is a good worker, water is abundant, and the smelting works are thoroughly up to date. In short, the industry has an assured and prosperous future.

The Cost of Mining as Influenced By Poor Development

Ultimate Expense Per Ton Increased by Hit-or-Miss Methods of Laying Out Workings—Money And Time Loss Through Unnecessary Footage of Drifts and Crosscuts Illustrated by a Concrete Example

BY A. G. WOLF

Written for *Engineering and Mining Journal*

MANY mines have been developed from small prospects into large properties, by the simple process of extending their workings in a hit-or-miss manner from the original discovery shaft or adit, resulting in a set of mine excavations that resemble in plan the labyrinthine openings of a big limestone cave. In some operations this is unavoidable, but where prospecting work and preliminary development have exposed the mineralized zone and the probable limits within which oreshoots are to be expected, the careful planning of development with the future operation of the mine in view may result in greatly increased profit. The best way to illustrate this is to give a concrete example.

In the mine used as an illustration, the ore had been formed by contact metamorphism. The oreshoots were of various sizes and irregularly spaced throughout a zone of fairly regular strike and dip. The strike of the zone was well marked on the surface, and, after certain preliminary development work and the completion of the main lower haulage tunnel, the dip was known. The major portion of the mine is now worked out, and produced say, 250,000 tons of ore during a period of thirty months. A study of the mine maps shows that instead of the winding, twisting and branching set of drifts and crosscuts that were driven, uniformly spaced parallel drifts along the zone and crosscuts at a certain regular interval would have exposed every pound of ore ultimately stoped, with a saving of 1,500 ft. in drifts and crosscuts.

The cost of this unnecessary development work applied to the tonnage of ore extracted amounted to about $0.065 per ton; not so serious taken alone, but many other factors affecting ultimate cost were involved. These are tabulated as follows:

FACTORS IN DEVELOPMENT AFFECTING ULTIMATE COST PER TON

1. Cost of extra footage driven.
2. Cost of extra equipment.
3. Cost of delay in supplying ore to reduction plant.

FACTORS IN ORE EXTRACTION AFFECTING ULTIMATE COST PER TON

4. Cost of straightening drifts and rounding turns.
5. Extra cost of inefficient tramming: Less tons per man-shift due to longer trams; interference; more wrecks; bad grades; more wear and tear on equipment; more lubrication.
6. Time lost by new men learning their way about crooked workings.
7. Cost of extra mine repairs.
8. Cost of lower efficiency due to poorer ventilation.
9. Extra overhead mine cost due to longer time to work out mine.
10. Extra overhead reduction-plant cost due to longer time to work out mine.

The factors listed above are discussed in detail as follows:

1. The cost of 1,500 ft. of excess drifts and crosscuts was estimated at $10 per ft., or $15,000. This included labor, general mine expense, and supplies except track, pipe, and lighting equipment.

2. The cost of equipment for extra footage is given in the following table:

COST OF EQUIPPING EXTRA DEVELOPMENT FOOTAGE

1,000 yd. 16-lb. tee rail at $3 per 100 lb.	$480
1,500 ft. 2-in. air line at 20c. per ft.	300
1,500 ft. 1-in. water line at 10c. per ft.	150
750 ties at 12c.	90
Spikes, bolts, fishplates	50
Lighting equipment	30
Total	$1,100

3. As to delay in supplying ore to reduction plant, no loss of time in operation resulted in this particular instance, chargeable to the extra time required to do the unnecessary development work, because the reduction plant drew its ore supply from several mines. It can readily be seen, however, that any delay in operating the reduction plant would have increased greatly the interest, depreciation, and overhead charges, and hence the cost per ton of ore extracted and treated.

4. After the development work was done many drifts had to be strightened and sharp turns rounded to permit motor haulage and to make hand tramming reasonably efficient. No actual figures of the cost of this work are now at hand, but a conservative estimate based on intimate acquaintance with the mine operations is $1,000.

5. The actual cost of hand tramming is known. This could have been materially reduced by planning the drifts and crosscuts in the first place. The drifts should have been reasonably straight and the crosscuts parallel to each other and at such an angle with the drifts that an easy turn could have been made in going in one direction from the crosscuts into the drifts. This would have resulted in greater tonnage per trammer-shift, owing to shorter trams, less interference of cars going in opposite directions, better grades, fewer wrecks on account of fewer curves, frogs, and switches, and lower cost of materials, as there would have been less wear and tear on the cars and less lubrication would have been needed. There must also be taken into account an indefinite but important factor, namely, the difference in spirit with which a man works when he has an easy tram and when he has a hard one. What the total saving under this heading would have been can only be estimated. After a careful consideration of the various factors, it is my belief that 25 per cent could have been cut from the cost of hand tramming. The total cost of this operation from the stopes alone was $42,750; hence at least $10,687 would have been saved.

6. The labor turnover was high, machinemen, machinemen helpers, trammers, and shovelers having to be replaced about once a month. The average time lost or 'killed" by new men in finding the working places in the crooked mine openings was easily one-half shift per man per month more than it would have been if the plan of the mine had looked less like a labyrinth of

classic antiquity. The total payroll represented by such labor, taking into account heading No. 5, was $138,370. There was incurred, then, a loss of one-sixtieth of $138,370 or $2,306.

7. The actual cost of mine repairs is known, and in this particular operation was quite low, especially as little timber was required. It is conservative to estimate, however, that $2 per day could have been cut from these repairs during the working time. As the tonnage under consideration was extracted in thirty months, there is an indicated saving of $1,800.

8. As all ventilation was by natural draft, aside from the blowing out of workings with compressed air from the drilling lines, no direct comparison of costs can be made, but it is certain that ventilation was poorer in the irregularly developed mine than it would have been had the mine been opened along the lines suggested. One set of drifts and raises could have been used for direct air courses and another set for return air courses. Poorer ventilation meant loss of efficiency, which actually influenced the cost of mining, although it cannot be shown here in dollars and cents.

9. To arrive at definite figures regarding the extra cost per ton of ore mined owing to slower operations, an assumption must first be made as to the percentage of the whole period of ore extraction that could have been saved by properly planned development work. After taking all factors into consideration, and knowing the mine, I believe that 10 per cent of the total time consumed in ore extraction could have been saved. There was, therefore, a loss amounting to 10 per cent of the overhead mine charges during this thirty-month period. Those monthly charges not already considered are given in the following table:

OVERHEAD MINE CHARGES PER MONTH

Superintendence	$250
Shift bossing	450
Engineering and clerical	300
Compressor operation	325
Tool sharpening and blacksmithing	440
Watching	90
Rock crushing	225
Nipping	90
Aerial tramway operation	900
Power	300
Total	$3,370

The 10 per cent loss, then, for the thirty-month period, expressed in dollars, was $10,110.

10. As to increased overhead cost of the reduction plant, it has already been stated that in this instance the plant did not depend upon this mine alone for its ore supply, so that no extra treatment charge per ton of ore would be made against the mine on account of the daily tonnage being smaller than that which could have been shipped. However, if the mine had been the only source of supply, this greater overhead charge at the reduction plant would have been serious.

The total extra cost of mining caused by the poorly planned development work follows:

TOTAL EXTRA COST OF MINING DUE TO POOR PLANNING

Extra development	$15,000
Extra equipment	1,100
Delay in supply of ore to plant	Nil
Straightening drifts	1,000
Cost of tramming	10,687
Time lost by new men	2,306
Extra mine repairs	1,800
Loss of efficiency due to poor ventilation	Not estimated
Greater mine overhead charges	10,110
Greater plant overhead charges	Nil
Total	$42,003

This is equivalent to $0.168 per ton, assuming the tonnage mined and treated to have been 250,000 during the thirty-month period.

It is realized that the above example is not applicable to the majority of mines, but there are many to which it will apply. With a present labor cost 50 per cent greater than that noted, and with a charge included for extra mill overhead costs due to slower production, the extra cost per ton of ore mined and treated as shown above might easily be doubled. A moderate exercise of foresight in planning mine development and in computing the overhead costs of administration and practical operation may be worth thousands of dollars. The success of the property may depend upon it.

Geology and Ore Deposits of Jerome District, Arizona*

Arizona stands pre-eminent as a copper-producing state. In 1918, it produced four-tenths of the total amount produced in the United States. The production of the Jerome district gives it the sixth place among the copper-producing camps of the United States and third among those of Arizona, being surpassed by Bisbee and Globe-Miami. Two mines furnish the entire output of the district—the United Verde and United Verde Extension. The United Verde is 2,500 ft. deep and has blocked out a large reserve of massive sulphides. The United Verde possesses one of the largest known bodies of high-grade chalcocite ore.

The oldest known rocks of the Jerome district are a series of pre-Cambrian volcanics, with later sedimentary beds. Subsequent to the formation of these rocks, they were squeezed into close folds, with strikes from east to north-northeast, and this deformation was followed by the intrusion of masses of quartz-porphyry. This porphyry was subsequently rendered schistose in limited zones; and masses of diorite were afterward intruded. Still later came the ore-deposition. In the later part of the mineralization diorite dikes were intruded along east-west lines.

All these events were pre-Cambrian, according to Dr. Reber. Later came Cambrian sandstone (100 ft.); then Devonian limestones, (300 to 500 ft.), Carboniferous limestones (300 to 500 ft.) and Permian red shale and sandstone (0 to 500 ft.). There was no further rock formation till the late Tertiary, when basaltic lavas were poured out. Still later came a period of profound normal faulting.

All the orebodies are highly pyritic, and pyrite predominates. Chalcopyrite and pyrite seems to have been the chief primary copper mineral. The primary sulphides carry also gold and silver. The orebodies have formed by replacement of schist. Among the other primary minerals are bornite, tetrahedrite, sphalerite, galena, and specularite; also calcite and dolomite, and quartz, especially of a jaspery variety.

Structurally, the United Verde mineralization has been determined by a steeply pitching inverted trough of relatively impervious rocks, indicating ascending solutions, which are assumed to be of magmatic origin. The igneous body most closely related to the mineralizing solutions is believed to be the Bradshaw granite, with which are associated similar schist-replacement copper orebodies south of Jerome. All the other pre-Cambrian intrusions mentioned, together with the Bradshaw granite, may be regarded as related to a single period of batholithic intrusion.

*Abstract of paper by Dr. L. E. Reber, Jr., presented at Lake Superior meeting of the A. I. M. E., August, 1920.
Abstract by J. E. Spurr.

Ball-Mill Tests on Missouri Lead Ore*

Variations in Speed and Ball Load Found To Be of Comparatively Minor Importance — Open-Discharge Cylindrical Mill With Large Balls Found Best Adapted for Securing a Product With Minimum of Slime

SOME interesting crushing tests were made in the Bonne Terre mill of the St. Joseph Lead Co. in 1916. The ore occurs as widely scattered deposits of galena disseminated through limestone. For the tests, material through 9-mm. and on 2-mm. round hole screens was used, an average screen analysis being about as follows: On 3 mesh, 3 per cent; on 4 m., 12; on 6 m., 17; on 8 m., 26; on 10 m., 25; on 14 m., 12; and through 14 mesh, 4 per cent. The mills used were a 6-ft. x 22-in. Hardinge mill, and a 6 x 4-ft. Allis-Chalmers ball granulator, both with and without grates.

The capacity of the ball mills and the nature of the product were considered to be governed chiefly by the following factors: Speed of rotation, weight of ball charge, nature and size of balls, moisture in feed, and rate of feed. Slime in the product was not desired.

Speed and Ball Load

The speed and ball load directly determine the power consumed. Within certain limits, variations in speed did not give a marked difference in the work done, but the tests in this direction were not extensive, nor the results conclusive. Apparently, not much variation was experienced between the limits of 420 to 490 ft. per min. peripheral speed for the cylindrical mill, and between 450 and 550 ft. per min., for the Hardinge.

Variations in the ball load also were found to be of comparatively minor importance. A heavy ball load consumed more power, but gave higher capacity, up to the point where the balls discharged through the trunnion, and the amount of crushing done per horsepower remained practically the same. Table I shows the combinations of speed and ball load that were found to give the best results.

TABLE I. SPEEDS AND BALL CHARGES

	6 ft. by 22 in. Hardinge Mill	6 by 4 ft. Allis-Chalmers Peripheral-Discharge	6 by 4 ft. Allis-Chalmers, Open Trunnion
Speed, revolutions per minute	28	23	26
Weight of balls, pounds	10,000	12,000	12,000
Horsepower	51.6	62.5	69.0

Size of Balls

The size of balls is important in determining the nature of the product. Balls of 5-in. diameter are necessary to crush the coarse ore. Small balls increase the slime in the product. During the earlier tests, when cast-iron balls were used, considerable trouble was experienced by the breaking up of the balls, until the charge consisted largely of very small pieces of 1-in. diameter or less. Samples taken from day to day during this period showed a gradual increase of oversize and in the amount of slime. The cast-iron balls were therefore replaced by steel balls from 5 to 2 in. in diameter. Various combinations of these sizes were used, and the highest capacity and lowest slime were obtained with a charge containing a large proportion of 5-in. balls. The charge now used is calculated to give an equal area in each size, a 12,000-lb. charge being made up of 5,460 lb. 5-in. balls, 4,040 lb. 4-in. balls, and 2,500 lb. of 2½-in. balls. New balls to make up for normal consumption are added weekly in the same ratio of sizes as the original charge; this practice has given satisfactory results.

Moisture Content

The moisture content of the material crushed affected the results mainly in the very fine sizes. A low moisture content increased largely the amount of slime in the product, without materially decreasing the amount of 10-mesh oversize. In the case of the peripheral-discharge mill, the difference is not so marked, but in all cases it has been found better to sacrifice a little capacity in order to obtain a product with low slime content. An average of 60 per cent moisture is, therefore, maintained in regular operation.

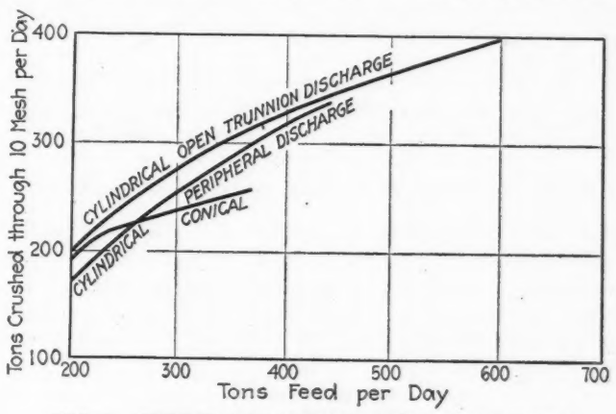


FIG. 1. EFFECT OF RATE OF FEED ON CAPACITY

TABLE II. MOISTURE TESTS ON HARDINGE MILL

	Test 1	Test 2
Tons feed per day	240 0	190.0
Per cent moisture	65.8	48.1
Horsepower	51.6	51.6
Capacity: Tons through 10 mesh	216.0	181.0
Tons through 10-mesh per hp.	4.18	3.51
Per cent slime in 10-mesh undersize	23.8	57.7

Rate of Feed

The effect of rate of feed is shown in Figs. 1 and 2, where the capacity and per cent of slime are plotted against the tons of feed per day, the moisture remaining constant at 60 per cent. The limits of the curves in each case represent the greatest tonnage that could be forced through the mills and maintained for any length of time. In the case of the peripheral-discharge mill, the tonnage was limited by the fact that when the 10-mesh oversize amounted to more than 25 per cent of the total, the mill began to fill and finally choked. With the open-end mills, a higher rate of feed was possible, giving a much greater capacity. This was one of the main factors that led to the adoption of the open-discharge cylindrical mill. Fig. 1 shows that the maximum capacity of this mill is 390 tons crushed to pass through a 10-mesh screen, against 340 tons for the peripheral-discharge mill, and 255 tons for the conical mill. By passing a very heavy tonnage through the mill,

*From a paper written for the Lake Superior meeting of the A. I. M. E., Aug. 23-28, 1920, "Application of Ball Mills in Southeast Missouri," by Lewis A. Delano and Harold Rabling.

the relative amount of slime is decreased considerably, as shown in Fig. 2; therefore, it is considered best to crowd the mill with a heavy tonnage having a high moisture content and to pass this through the mill rapidly, returning a large amount of oversize. This method of operation also decreases the ball and liner consumption by preventing undue wear of metal on metal.

Table III shows a comparison of the three types of ball mills, with the conditions under which best results were obtained, and the maximum capacity of each mill. The results shown were obtained under closer supervi-

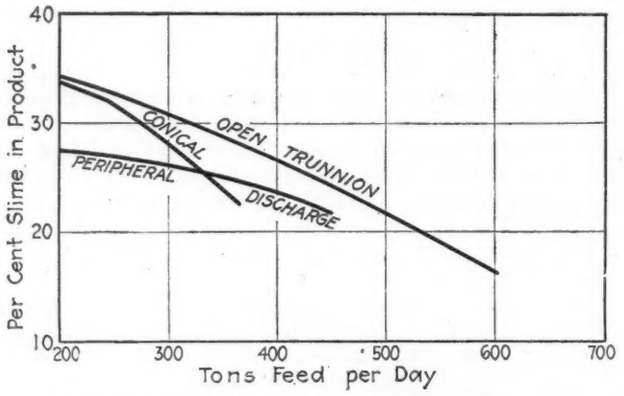


FIG. 2. EFFECT OF RATE OF FEED ON SLIME

sion than is possible in regular operation and which could not normally be maintained. In Table IV is shown an average condition at a normal operating rate, one that gives a product containing from 20 to 25 per cent of 10-mesh oversize for each mill, and has been found

TABLE III. OPERATING CONDITIONS AND MAXIMUM CAPACITY OF BALL MILLS

	Hardinge Mill	Allis-Chalmers Peripheral-Discharge Mill	Allis-Chalmers Open Trunnion Mill
Speed, revolutions per minute	28	23	26
Weight of balls, lb.	10,000	12,000	12,000
Size of balls, in.	4–2½	5–4–2½	5–4–2½
Material of balls	Steel	Steel	Steel
Tons of feed per day	370.0	450.0	600.0
Per cent moisture	59.3	59.5	60.0
Horsepower consumed	51.6	62.5	69.0
Delays, per cent time	1.41(*a*)	6.44	0.70 (*b*)
Capacity, tons through 10 mesh	2.55	3.40	3.90
Tons through 10 mesh per hp.	4.93	5.45	5.65
Per cent slime in product	22.7	21.88	17.0

(*a*) Percentage delay on account of feeders breaking off, 1.35; other causes, 0.06.
(*b*) Percentage delay on account of gears, shafts, and countershaft bearings, 0.55; other causes, 0.15.

to be most satisfactory in every way. Under these conditions, the Allis-Chalmers open-discharge mill has the highest capacity, and shows the best ratio of tons crushed per horsepower. Examination of the products of each mill shows that the Hardinge mill produces more slime lead than the cylindrical type, and that the peripheral-discharge type gives a good product containing a larger amount of granular galena than either of

TABLE IV. NORMAL CAPACITY OF BALL MILLS

	Hardinge Mill	Allis-Chalmers Peripheral-Discharge Mill	Allis-Chalmers Open Trunnion Mill
Tons of feed per day	300.0	375.0	450.0
Per cent moisture	60.0	60.0	60.0
Horsepower	51.6	62.5	69.0
Capacity, tons through 10-mesh.	237.0	305.0	345.0
Tons through 10-mesh per h.p.	4.60	4.88	5.00
Per cent slime in product	28.2	24.2	24.1

the others. However, mechanical troubles and delays were so great and the capacity was so limited by the grates that it was considered better to use the open-trunnion mills, which were installed in all sections of the Bonne Terre mill.

Krupp Mills vs. Rolls for 10-Mesh Grinding

Tests in Bolivia Showed Latter With Newaygo Screens To Be Preferred Equipment—Rolls Cut Costs But Product Not as Fine

FINE grinding is ordinarily done in the presence of water, but occasionally metallurgists are confronted with the problem of grinding to approximately 10-mesh in the dry condition. For this purpose, rolls or ball mills of the Krupp type are commonly used. In a paper prepared for the Lake Superior meeting of the A. I. M. E., entitled "Roasting and Chloridizing Bolivian Silver-Tin Ores," M. G. F. Söhnlein describes how the ore was ground for the chloridizing roast. Originally, Mr. Söhnlein says, No. 4 Krupp ball mills were used, but they were replaced by two pairs of 36 x 12-in. rolls. The rolls did the work for less than one-third of the cost of the ball mills, but gave a distinctly coarser product, which decreased the furnace capacity considerably. Therefore, a Toncap wire cloth of only 0.85-mm. opening was used on the finishing screen instead of one with 1.2-mm. opening on the ball mills, to obtain a product that was suitable for the furnaces. The first rolls were set with a ¼-in. opening, and their product went to a trommel with ⅜-in. openings, the oversize being returned to the coarse rolls and the undersize going to the finishing trommel, which was 42 in. in diameter and 12 ft. long. The last trommel was operated in closed circuit with the finishing roll.

Afterward, a ring-roll mill was installed to do the work of the fine rolls and a 6 x 8-ft. Newaygo screen was used instead of the trommel. Although with this arrangement the product was as fine as that from the ball mills and the capacity higher than from the roll plant, it was not found economical, on account of the high power and steel consumption of the ring-roll mill, which also showed other weak points in construction after having been used for some time. Now the rolls are again used, but with a Newaygo screen instead of the finishing trommel. Although the product is not quite as fine as that from either ball mills or ring-roll mill, it is sufficiently fine for the purpose. The cloth on the Newaygo screen, which is a No. 8 with 0.078-in. opening, lasts over two months, and the screw conveyor which distributes the ore evenly over the screen surface has a life of about seventy-five days. Power consumption is 11.8 hp.-hr. per ton ground from 2 in. maximum size to about 1 mm., and steel consumption is 0.38 lb. per ton.

SCREEN TESTS OF BALL-MILL AND ROLL PRODUCTS

Mesh	Krupp Ball Mill 1.2-Mm. Toncap Wire Cloth, per Cent	Rolls with 0.85-Mm. Trommel, per Cent	Rolls with Newaygo Separator, No. 8 Cloth, 1.9-Mm. Opening, Per Cent	Roughing Rolls and Ring-Roll Mill with Newaygo Separator No. 6 Cloth, 3.0-Mm. Opening, per Cent
On 10	3.0	0.0	1.5	4.0
On 20	17.0	19.0	16.0	24.5
On 40	24.0	31.5	19.5	20.0
On 60	8.5	11.0	23.0	5.5
On 80	7.0	10.0	8.0	4.0
On 100	5.0	5.5	5.5	6.5
On 150	3.5	4.5	4.5	9.0
Through 150	32.0	18.5	22.0	26.5
	100.0	100.0	100.0	100.0

The table shows how the sizes of product compared, under the different methods of grinding which were used.

Selecting a Slag and Apportioning Slag Losses

Detailed Method of Calculating Slag and Matte Composition From a Given Charge—Various Means of Charging for the Copper Loss—Advantages of Basing It on Iron Contents of Slag

BY C. A. GRABILL*
Written for *Engineering and Mining Journal*

THREE general conditions may exist in a given smelting works: That condition or circumstance in which the available ore will produce approximately an ideal slag, and under which, consequently, no fluxes will be required; that in which an excess of bases is present; and that in which there is an excess of siliceous ores, lime and iron fluxes being required. The last of these three is the most common, and as a schedule can be based on only one condition at a time, a definite example of that kind will be taken to make the method of cost calculation clear.

Assume that the materials available are: *A*, an oxidized siliceous ore from the smelting company's mine, forming the basis of operations; *B*, a sulphide flux available in the market at $9 per ton delivered at the smelter; *C*, limestone from a neighboring quarry costing $2 per ton delivered; *D*, an iron ore from a small near-by mine; and, *E*, a custom ore available if required.

The coke will be assumed as average quality with 20 per cent ash, the analysis of which is given below. Costs will be assumed to be as follows: Coke, $10 per ton; smelting, 10 per cent coke, $1; fixed expense, including overhead, $1; variable expense, $1; semi-variable expense, $1; total, $4. These figures are of course arbitrary.

The marketing expense of copper will be taken as 2.5c., made up of freight, 0.5c.; converting, 0.5c.; refining, 1.25c.; and selling commission and overhead, 0.25c. The market price will be assumed at 22.5c., leaving the works value 20c. per lb. of copper. The market price of silver will be assumed to be $1.26 per oz., with a marketing expense of 1c. per oz.

Obviously, no roasting or sintering will be required, and it is also assumed that all ores and fluxes will take the same treatment, so that the above smelting expense is applicable to all components of the charge in accordance with their tonnage.

The assumed analyses are as follows:

Ore	Silver, Oz. per Ton	Copper, per Cent	SiO_2, per Cent	Fe, per Cent	CaO, per Cent	Zn, per Cent	Al_2O_3, per Cent	S, per Cent
A	20.0	3.0	50.0	10.0	18.0	1.0	4.0	1.0
B	1.0	1.0	4.0	48.0	....	2.0	....	44.0
C	....	....	2.0	....	54.0	....	1.0	....
D	....	....	4.0	65.0	....	....	2.0	....
E	80.0	....	80.0	5.0	....	1.0	2.0	6.0
Coke ash	....	....	50.0	15.0	2.0	....	25.0	....

To simplify calculations, gold assays have been omitted.

Because most of the smelters operating with excess silica use a slag containing about 42 per cent SiO_2, and find 36 per cent Cu in the matte a fairly satisfactory amount, it will be assumed that the copper losses will follow the curve in Fig. 4,[1] and 42 per cent SiO_2 will be taken for the standard slag. There is no particular reason for this, other than that it is convenient, and 41 or 43 would do just as well.

Slags do not vary by steps, as the theory of type slags would require, but gradually. Similarly, 36 per cent matte works well in the converters, is high enough to retain its collecting power, and low enough to prevent excessive losses. A slight variation each way does not make much difference, because of the compensating action of its diversified effects.

TABLE I. CALCULATION OF CHARGE

Material	Amount	Ag		Cu		SiO_2		Fe		CaO		Al_2O_3		S	
	Lb.	Assay	Oz.	%	Lb.	%	Lb.	%	Lb.	%	Lb.	%	Lb.	%	Lb.
A	620	20.0	6.20	3.0	18.6	50.0	310.0	10.0	62.0	18.0	111.6	4.0	24.8	1.0	6.2
B	180	1.0	0.09	1.0	1.8	4.0	7.2	48.0	86.4	....	....	....	....	44.0	79.2
C	200	....	....	....	....	2.0	4.0	....	....	54.0	108.0	1.0	2.0	....	....
Coke	(100)	....	....	....	....	10.0	10.0	3.0	3.0	0.4	0.4	5.0	5.0	....	....
Total	1,000	....	6.29	...	20.4	....	331.2	....	151.4	....	220.0	...	31.8	....	85.4

$85.4 \times 0.15 \div 0.25 = 51.24$ = Wt. of Matte*
$20.4 - 2.10 = 18.30$ = Wt. of Cu in Matte
$18.30 \div 51.24 = 35.6$ = % of Cu in Matte
$51.24 \times 0.34 = 17.4$ = Wt. of Fe in Matte
$151.4 - 17.4 = 134.0$ = Wt. of Fe in Slag
$134.0 \times 1.287 = 172.3$ = Equivalent FeO

Slag Content:	Lb.	%
SiO_2	331.2	42.1
FeO	172.3	21.9
CaO	220.0	27.95
Al_2O_3	31.8	4.05
Miscellaneous	31.7	4.00
Total	787.0	100.00

$20.4 - 18.3 = 2.1$ lb. Cu in slag = 0.267%
Or, Cu in slag (from Fig. 2) = 0.267%
From Fig. 3, Ag in slag = 0.82 oz. per ton and Ag in matte = 233 oz. per ton

Slag loss: Ag, 5.1%; Cu, 10.3%
Cu loss per ton of charge, 4.2 lb.
Cu loss per ton of slag, 5.34 lb.
Cu loss per lb. FeO in slag, 0.01218 lb.
Cu loss per lb. Fe in slag, 0.01567 lb.
Cu loss per unit of Fe in slag, 0.3135 lb.
1 lb. Cu in matte requires 0.95 lb. Fe

Slag Ratios

$$\frac{FeO}{SiO_2} = 0.52 \qquad \frac{Fe}{SiO_2} = 0.4046$$

$$\frac{CaO}{SiO_2} = 0.664 \qquad \frac{FeO + CaO}{SiO_2} = 1.185$$

$$\frac{S \text{ in charge}}{Cu \text{ in matte}} = 4.66$$

METHOD OF CALCULATING FURNACE PRODUCTS

The results of the calculation on this basis are shown in Table I. The procedure is to set down the weights of the proposed components of the charge and their constituents, and add up the total of each element as indicated. The total weight of sulphur is then multiplied by 0.15 (the assumed recovery of sulphur) and divided by 0.25 (the amount of sulphur in the ordinary

*The second of a series of three articles on the calculation of copper blast-furnace charges and costs. The first article was published in the Sept. 11, 1920, issue of *Engineering and Mining Journal*.

[1]See p. 512 in the Sept. 11, 1920, issue of *Engineering and Mining Journal*.

matte), and the result is the weight of matte that will be produced by the charge. Knowing this, and the amount of copper on the charge, it is easy to make a guess at the grade of matte and the slag loss. Deducting the copper lost in the slag from the copper charged, and dividing the result by the number of pounds of matte made, gives the grade of matte. Knowing this, the iron in the matte is calculated easily.

In this instance the sulphur, iron, and copper contents of the matte are assumed to total 95 per cent. In practice the iron would be determined from a plot showing the iron contents of average mattes of different grades under the works conditions, or else allowances would be made for the zinc and lead contents, if required.

The iron in the matte is deducted from the total iron charged and the remainder calculated to FeO. The silica plus FeO plus CaO plus Al_2O_3 are assumed to be 96 per cent of the total slag, or whatever experience dictates. If present in sufficient quantities, zinc, barium,

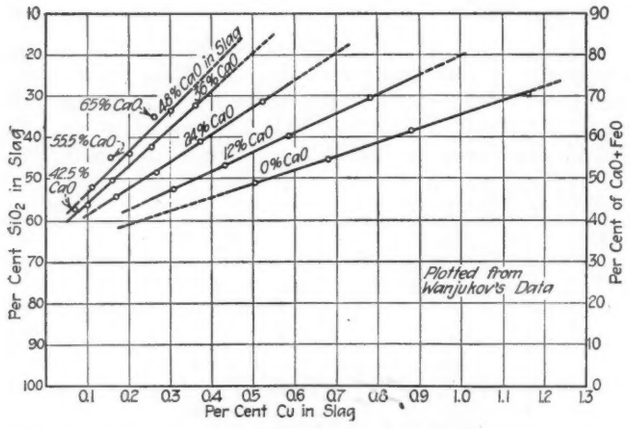


FIG. 7. RELATION BETWEEN SLAG COMPOSITION AND COPPER ASSAY OF SLAG FOR 30 PER CENT Cu MATTE

and magnesia would be included and suitable totals taken. These figures give the total weight of slag, and referring to Fig. 4 for the copper assay corresponding to the grade of matte, the slag loss is calculated. If the guesses have been good, nothing remains to be done, but if the results do not check, the calculation must be repeated. The second result should be correct. The silica, iron, and lime percentage is calculated; the silver loss, using Curve *A* of Fig. 5*, and all the other data are shown in the table.

For furnace work, many of these refinements would be omitted, because changes in ore and furnace conditions outweigh them. The course of procedure in 75 per cent of the charges put in the furnace is to look at the slag reports, the matte assays, the stockpile, and the furnaces, and, if necessary, add 10 kilos of sulphide flux and cut the limestone 20, or whatever seems to be required. But in working out the principles on which these short-cuts are based, the long elaborate procedure is usually strictly necessary, and all the refinements available should be considered, whether used or not.

The slag calculated is a little high in lime, and therefore its use is supposed to be somewhat dangerous. But it is similar to one I once used for several months, and, from the assumption, iron flux is expensive, and so the slag will be taken as a basis for the other calculations. In actual operation, the slag losses in both copper and silver did not conform to the curves in Fig. 4 and *A* of Fig. 5, owing to certain local conditions.

With this slag as a starting point it becomes possible to ascertain the value of its component fluxes and to calculate the cost of fluxing and smelting an ore of any given analysis, provided that this grade of matte, and a slag with this silica content, are used.

Because the capacity of the plant does not enter into the question at this point, the cost of smelting a ton of neutral ore will be assumed to be the total cost, that is, $4 per ton. The simplest method of calculating the cost of smelting a ton of ore *A* will be, taking the data from Table I:

Smelting 620 lb. ore *A* at $4 per ton	$1.24
200 lb. limestone, at $2 per ton	.20
180 lb. sulphide flux at $9 (less credit for 20 lb. Cu per ton at 20c., and 95 per cent of 1 oz. of Ag)	.34
Smelting 380 lb. flux at $4	.76
Copper loss, 2.1 lb. at 20c	.42
Total for smelting and fluxing 620 lb.	$2.96
Cost of smelting and fluxing one ton	$9.55

This is entirely correct, so far as it goes, but it does not go far enough and will not enable one to calculate the cost of the ore, if the silica changes, without recasting the whole charge sheet. Neither does it permit of ready valuation of a new ore, or supply the basis of a tariff to guide the mine superintendent.

Apparently the cheapest source of flux is the limestone; so the first thing is to ascertain the cost of a unit of CaO.

Limestone, one ton	$2.00
Smelting, one ton	4.00
2 units of SiO_2 require 0.81 unit Fe at 24.39c.	.20
Fluxing coke ash (10 per cent coke, 20 per cent ash)	.12
54 units CaO less 1.33 for the 2 per cent SiO_2 cost	$6.32
1 unit CaO costs	12.00c.

The use of iron for fluxing the SiO_2 in the limestone is assumed because the slag in this case is so high in lime that it would not be advisable to increase it; therefore, all silica must be charged with the corresponding amount of iron for fluxing.

The cost of the iron and fluxing the coke ash must be estimated until determined. If the guess is wrong, correction must be made. In practice, the cost of fluxing the coke ash would be charged to the cost of coke.

The cost of a unit of iron is determined in the same manner:

Cost of one ton of sulphide flux	$9.00	
Smelting one ton	4.00	
Fluxing coke ash for one ton	.12	
4 units of SiO_2 require 2.66 units CaO at 12	.32	
Copper loss of 0.3135 lb. per unit of Fe. 48 units Fe = 15.05 lb. (Cu at 20c.)	3.01	
Credit for 1 unit = 20 lb. (Cu at 20c.)		$4.00
Credit for 1 oz. silver, 95 per cent, at 1.25		1.19
Iron required for matte for 4.95 lb. Cu recovered at 24.39c. per unit Fe	.06	
Credit for overcharge for copper loss in last item		.01
	$16.51	$5.20
	5.20	
48 units Fe less 1.62 for 4 per cent of SiO_2 cost	$11.31	
1 unit of Fe costs	24.39c.	

The silver loss has been taken up in the conventional way, at 5 per cent, but this is not correct, as will be shown.

No credit has been allowed for sulphur, because its computation is a rather complicated matter and is generally considered separately. However, this value will be determined later and it will be shown that it has a big effect on the iron value, and that the method of calculating here indicated is correct only in instances where an oxidized iron ore is required for flux; it is,

*See page 513 of the Sept. 11, 1920, issue of *Engineering and Mining Journal*.

therefore, not correct in this instance. However, it would be correct if the sulphur were in ore *A* and not in *B*. I have used the method as shown so as to give an example in which sulphur does not enter the question, and then to show the big difference to be noted when it must be considered. If, in this case, the sulphur were in the ore *A* and not in *B*, still *B* would have to be used as a source of iron, and the above calculation would be correct. Therefore that assumption will be made for the present.

METHODS OF CHARGING FOR COPPER LOSS

The method used of charging for the copper loss is unusual, but is the nearest approach to accuracy that is practicable. Several methods may be suggested, but, if the results do not agree, not more than one can be correct; it is of importance to know which to use. The most obvious method is to consider all the copper in the slag as derived from the principal ore, and this would be reasonable in some instances; but suppose there are two principal ores, one silver-bearing without copper, and the other copper without silver? Another method is to apportion the loss, calculating it in pounds per ton of charge and distributing the loss to all ores and fluxes in accordance with their weight. This is a simple method, both in practice and thinking. (See *B*, Table II.)

Suppose that the company bought an old slag dump, and that the regular ore was a mixture of gypsum, hydrated ferrous carbonate, and silicates with combined water. In the first case a ton of charge would make a ton of slag, and in the other, a ton of charge might make less than half a ton of slag. I have before me the analysis of an ore containing only about 46 per cent of slag-forming elements. Nor is this question purely hypothetical. If the smelter slag contains 0.45 per cent Cu, which is not uncommon, the loss will be, at the present price of copper, about $1.80 per ton of slag, and it may be a question of getting or losing a contract whether the ore is charged with half or all of this, or the difference averaged.

Another method would be to apportion the losses on the percentage basis. (See *C*, Table II.) This does not allow for the effect of the ore on the slag losses. Or, the losses may be charged in proportion to the slag-forming constituents. The objection is that one ore might be a self-fluxing ferrous silicate which would have a very foul slag, and the other ore might be a garnet ore, high in lime, giving a clean slag. The use of silica as a base for the apportionment is open to the same objection. (See *D*, Table II.)

The method which I have adopted is to base the losses on the iron contents of the slag. This has its objections also, but they are less than those incident to the others, and the principle is of much broader application. (See *A*, Table II.) For example: It is common in smelter practice to keep the silica constant and to vary the proportions of iron and lime. There are many reasons for this. Reference to Fig. 1 will show that a great difference exists between the amounts of copper dissolved in iron slags and in lime slags; practice bears this out. The last method allows for this effect in calculating losses, not only qualitatively but quantitatively, with a fair degree of accuracy, at least within the range of ordinary smelting practice. The curves in Figs. 7 and 8 show this. Fig. 7 is plotted directly from the data given by Wanjukov. Fig. 8 is plotted from Fig. 7 by interpolation on the curves drawn to connect the points located by Wanjukov's data. The effect of the iron on the copper loss may seem to vary too much to use a fixed ratio, but if the line *AB* is drawn on Fig. 8, the composition of the slags lying below it will be found not practicable for actual use.

The amount of Cu loss per pound Fe is determined by dividing the copper loss as shown in Table I by the

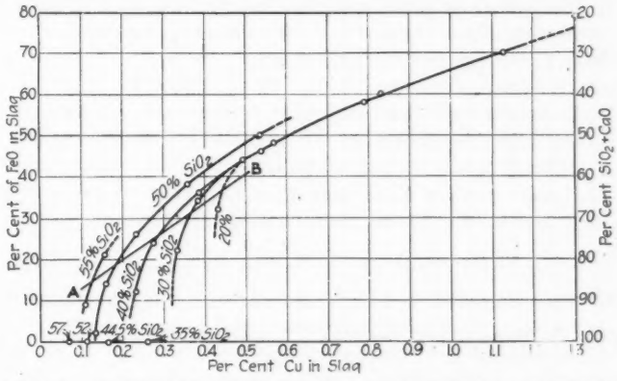


FIG. 8. INTERPOLATED CURVES FROM FIG. 7 SHOWING RELATION OF SLAG COMPOSITION TO COPPER CONTENT

Fe contents of the slag. Multiplying the result by 20 gives the loss per unit of Fe. Of course, this applies only within the definite limits.

Having determined the cost of the iron and lime the cost of fluxing a unit of silica is easily found.

1 unit of SiO_2 requires 0.664 unit CaO at 12.0c.	7.97c.
1 unit of SiO_2 requires 0.4046 unit Fe at 24.39c.	9.87c.
Cost of fluxing 1 unit of SiO_2	17.84c

The cost of smelting a ton of pure quartz would be:

Cost of fluxing 1 ton of SiO_2 (100 units)	$17.84
Cost of smelting 1 ton	4.00
Fluxing ash in coke	.12
Total	$21.96

The cost of fluxing the coke ash can also be determined:

50 units of SiO_2 at 17.84c.	$8.92	
Copper loss due to Fe; 15 units at 0.3135 lb. per unit = 4.7 lb. Cu at 20c.	.94	
Credit for 15 units of Fe at 24.39c.		$3.66
Credit for 2 units of CaO at 12.0c.		.24
	$9.86	$3.90
	3.90	
Cost of fluxing 1 ton of ash	$5.96	

The cost per one ton of charge would be 20 per cent of 10 per cent of the $5.96, or 12c. The cost of smelting the ore would be:

Smelting 1 ton	$4.00	
Fluxing coke ash for one ton	.12	
50 units of SiO_2 at 17.84c.	8.92	
Cu loss due to 10 units of Fe at 0.3135 lb. = 3.135 lb. at 20c.	.63	
Credit for 10 units Fe at 24.39c.		$2.44
Credit for 18 units CaO at 12c.		2.16
Iron for the matte; 56.85 lb. Cu = 2.7 units Fe at 24.39c.	.66	
Credit for overcharge for copper loss in the Fe going into the matte		.17
Total	$14.33	$4.77
	4.77	
Cost of smelting and fluxing 1 ton ore	$9.56	

That the importance of the correct apportionment of the losses be thoroughly understood, I have calculated the cost of silica, iron, and lime by the methods mentioned above and compared them in Table II.

TABLE II. COSTS BY DIFFERENT METHODS OF CALCULATION

Cost of	*A*	*B*	*C*	*D*
1 ton limestone	$6.32	$7.04	$6.27	$6.32
1 unit of CaO	12.0c.	13.36c.	11.90c.	12.00c.
1 ton of sulphide flux	$11.31	$9.24	$8.83	$8.51
1 unit of Fe	24.39c.	19.92c.	19.03c.	18.83c.
Fluxing 1 unit of SiO_2	17.84c.	16.95c.	15.61c.	17.81c.
Smelting 1 ton of pure SiO_2	$21.96	$21.07	$19.73	$21.93

Method *A* is the method recommended above, charging the copper losses against the iron in the slag.

Method *B* is based on a uniform distribution of the loss in proportion to the tonnage, 4.2 lb. per ton in this case.

Method *C* proportions the copper loss on the percentage basis. In this case it is 10.4 per cent of the copper in the ore.

Method *D* is based on the distribution in accordance with the silica contents of the material charged, 12.68 lb. of copper per ton of silica.

The amounts are all taken from Table I.

It is obvious that something is wrong. A smelter operating on a profit of $1 per ton of ore would have a difficult time if the metallurgist could not calculate the costs within $2.80 per ton. A little consideration will aid in discarding the bad methods.

Substitution of Iron Ore for Limestone

Take method *B* first: So far the sulphur contents of these ores have been assumed to lie in ore *A*, not in the flux *B*. This can be done without throwing things out of balance. Assume, also, that the sulphide flux contains enough silver to make the cost of a unit of FeO equal to that of a unit of CaO. It is then clear that for fluxing purposes the iron ore may be substituted completely for the limestone without throwing the metal losses out of balance if method *B* be used. Doing this would produce an irony slag with much less lime and it would consequently be a fouler slag. The first method allows for this. The same reasoning would apply for the other two methods if the iron flux contained no copper. Method *A* covers the point in all cases.

A method which would be correct for every condition that may arise is, of course, impossible of conception or contrivance. Data are lacking, and the formula would be too cumbersome for general use. The best course is to follow medical practice and "diagnose by exclusion," until a method suited to the case is found, but it must constantly be borne in mind that all conclusions should be carefully tested. The lead pencil is a wonderful little instrument, but will lie like Ananias if not closely watched.

Exports of Mineral Products from Burma

The exports of minerals from Burma during the last three years were as follows:

Articles	1917 Tons	1918 Tons	1919 Tons
Wolfram:			
Foreign	4,542	4,744	4,799
Tin:			
Foreign	214	300	371
India	15	116	90
Pig lead:			
Foreign	10,351	10,569	9,223
India	2,813	5,824	8,708
Zinc:			
Foreign	3,198	2	.....
India	33	14	.....
Silver:			
India	(a)	(b) 1,653,000	(b) 1,973,00

a No statistics before 1917–18. b Ounces.

There was an increase in the quantity of nearly every kind of mineral exported, but the fall in the price of some minerals has prevented a corresponding increase in value. Since the close of the period covered by this report the price of wolfram has taken a great drop, and exports of this metal will undoubtedly be considerably smaller, both in quantity and in value, in the following year.

Phosphate Rock in the United States*

The principal deposits of phosphate rock in the United States are in Florida, South Carolina, Tennessee, Kentucky, Arkansas, Montana, Idaho, Wyoming, and Utah. Although by far the largest deposits are in the Western states, those deposits yield less than 1 per cent of the whole, because of the lack of a large near-by market and high freight rates on the crude rock. It is not a matter of common knowledge, but it is, nevertheless, a fact, that the Western rock-phosphate deposits are so extensive as to be practically inexhaustible, even if the entire world were dependent on them for its supply of phosphate.

The Florida phosphate deposits, which are the most extensively developed in the United States, comprise three classes of phosphate—hard rock, land pebble, and river pebble. The first is highest grade, the second is produced in largest quantity, and the third is not mined at present. The hard-rock deposits lie in a narrow strip along the western part of the Florida peninsula from Suwanee County to Pasco County, a distance of approximately 100 miles. The land-pebble phosphate area, just east of Tampa, is about 30 miles long and 10 miles wide. Sales of Florida phosphate declined tremendously after 1913 through the restriction on exports by the war. In 1913 the sales were 2,500,000 tons, valued at $9,500,000, and in 1915 the production was 1,350,000 tons, valued at $3,700,000.

South Carolina produces land-rock phosphate in the vicinity of Charleston. River-pebble phosphate occurs in the same area, but is not mined. Some of the South Carolina output has been exported annually. Sales decreased from 169,000 tons in 1911 to 83,000 in 1915, and the value in the same years decreased from $673,000 to $311,000.

RESERVES OF PHOSPHATE ROCK IN THE UNITED STATES

	Long Tons
Florida	227,000,000
Tennessee	88,000,000
South Carolina	9,000,000
Kentucky	1,000,000
Arkansas	20,000,000
	345,000,000
Western States:	
Montana, Idaho Utah and Wyoming	5,367,082,000
Total	5,712,082,000

Tennessee deposits of rock phosphate are in the west-central part and extreme northeast corner of the state. The latter have not been mined. Three types are recognized and known by their colors as brown, blue, and white rock. The last has not been mined recently. The brown rock is sold under guarantee of 70 to 80 per cent tricalcium phosphate. The blue rock varies considerably in its phosphatic content. Sales of Tennessee phosphate in 1914 were 483,000 tons, valued at $1,823,000; by 1915 they had fallen to 390,000, valued at $1,328,000.

Kentucky has been an insignificant producer of phosphate rock in recent years. Arkansas phosphate deposits are in the north-central part of the state. The output is small.

Four Western states possess enormous deposits of high-grade rock phosphate, but their output is as yet insignificant, being only 3,000 to 5,000 tons a year. The producing states are Idaho, Utah, and Wyoming. Montana is not a producer, although it contains extensive deposits easy of access and close to rail transportation.

*R. W. Stone in "Political and Commercial Geology," McGraw-Hill Book Co., 1920.

A Picturesque Mining Experience—IV

The Bear Facts

BY CHARLES HALEY
Written for *Engineering and Mining Journal*

IN THE summer of 1916, Charles Janin, assisted by me, made a placer examination in the Little Delta region, in Alaska. The trip itself was mainly interesting on the Fairbanks end, so there is where my story begins.

After a delay of a tiresome week in Fairbanks, our deputed guide and conductor—who will have to be nameless, because most of the names we had for him would not look well in print—said that a car would be waiting for us in the morning. As matters turned out, he was wrong—we were waiting for it. About 10 o'clock it finally flivvered up on three lungs in front of the hotel. Besides the driver, there were four and a half of us in the car, one member of the party weighing over three hundred.

It had rained the night before, and the road was improbable before we were a mile out; beyond that it rapidly became impossible; and before we arrived at Eighteen Mile House it was beyond belief. We squattered past a team about two miles out; and later had to get it to pull us through. The flivver itself was a tribute to the great pacifist who designed it; like him, it was shy on power, but willing to take an awful lot of knocks. Whenever it stuck its nose in the road and refused to budge, we would pile out, hunt up a pole and a root for a fulcrum and our heavyweight friend with one foot would pry it up to a normal position. You could tell by the noise of the three operating cylinders when it was ready to die, and forestall the final agony most every time: "I think I can; I think—I can; I—think—I can; I—know—I—can't."

Anyway, we arrived at Eighteen Mile roadhouse about 3 o'clock and had lunch. From there on, the road was better, and we made Munson's roadhouse, on the Salchaket, in time for dinner, with Fairbanks forty miles away. We stopped and fought mosquitoes for about twelve hours, after which period of rest and refreshment we snorted forth again.

Arriving at the turn-off of the winter trail, the car gave up the ghost, and we had to pack our belongings to Martin's roadhouse, about two miles and two hundred million mosquitoes away. This roadhouse is on the wrong side of the Tanana, and we had to be ferried across by Archie. He, with the possible exception of our chaperon, was the most unusual institution of the entire trip. Before he made the landing, we were impressed by the fluency and weight of his verbiage; and as we stayed for nearly three days, we had a magnificent chance for observation. Two of his leading observations, "The cur-r-rse of Cain rest on yez all," and "be the bald-headed mother of Judas," were used as a foundation for a most startling structure of cusswords. When he locked horns over a small matter with our local Fremont, and woke us up at 3 o'clock in the morning to tell us about it, we thought him little short of sublime; it was worth being wakened for.

We finally managed to make our getaway to the property. The original idea, too original, as it proved, was to take a team and wagon all the way up the Delta River to the property, supposed to be a distance of about thirty miles. As it worked out, the trip was made by pack animal; but not until we had wasted the first day in attempting to cut through about half the stunted firs and young birch and alder growth in central Alaska. Our team unfortunately was not arboreal of habit, so we gave up the attempt after the first day and returned to Martin's with our faith in our self-appointed Nestor sadly shaken by this and other breaks too numerous to mention.

We managed to pick up a real guide—henceforth known as Frank—and decided to make the trip with what animals we had. This meant that one horse had to carry a pack, while the other was divided between us for riding purposes. A little providential inspection of the grub supply prevented us from setting forth with half a case of condensed milk and half a pound of bacon on what afterward proved to be a three-day journey; and, much to the disgruntlement of our pathfinder, we insisted on a few more of the luxuries of life. As the trip turned out to be about fifty miles, with very little trail and some 30 per cent grades to negotiate, our respect for his judgment was not enhanced from day to day.

We saw quite a bit of game—three moose, a caribou, and a black bear—on the way up, and were quite disgusted that none of them would pose for his picture. Arriving at Portage Creek on the morning of the third day, in the midst of a driving rain, our eyes were cheered by a collection of canvas doghouses wherein we lived until the examination was completed. This operation concluded, we decided to return under Frank's care, leaving our cicerone on the claim. He had the only gun of the party, so we set out weaponless.

About four or five miles on the homeward trail, we saw a bunch of mountain sheep; too far away to shoot even if we had had a weapon. And then came the main excitement, in fact, it might be called the big tent show of the entire trip. It was nearly lunch time, and we had both been discussing how hungry we were. We were traveling along the edge of a basin which we were due to cross within a couple of miles and into which the ground sloped precipitously off from the bluff on which we were. On the other side was a long gentle slope into a series of gullies at the head of Iowa Creek. Down one of these gullies we saw three animals which we at first took for caribou at the distance—about a mile.

Going over a little closer, with the idea of sizing them up for a picture, they caught sight of us. They immediately began running, not away, but toward us, with real speed, and we saw that they were either glacier bear or silvertip grizzly. We did not stop to ascertain which, but beat it for all we were worth. Clumsy and lumbering as they were, and bigger than all outdoors, they were gaining on us about four for one, and we knew pretty well what it meant if they ever caught up with us. We had one short knife and an axe in the pack, and those bear meant business. We forgot all about taking pictures and being hungry, and ran for our lives. Fortunately the horses did not see them, or they would have bolted.

The ground favored us; for while the bear were charging up the middle of the gully, we went out of sight over the top of the next draw. Coming to the top of the draw where we had been, they saw us again, and turned after us. By this time we had come to the top of the next bridge, and dropped down out of sight. Soon we came to where our trail went down into the basin, and we kept behind a ridge which hid us from them. We didn't stop for lunch until nearly 4 o'clock, and then we didn't feel so awfully hungry.

With the good start we had, we concluded to keep on going to Martin's, and we traveled the better part of the night, arriving early in the morning. After a couple of hours' sleep and a good breakfast, Archie ferried us across the river again. His usual string of objurgations was intensified, as the Tanana was rather high, and neither his rowlocks nor his steersman—who happened to be myself—was working to his fancy.

Followed two mosquito-ridden miles to Birch Lake roadhouse. Here we caught the stage in for Fairbanks, and bumped our beatific way toward civilization and the Arcade restaurant.

Copper a Hundred Years Ago

Price Range at That Time Not Essentially Different From That Obtaining Now—No American Market for Ore

RECENTLY we were asked as to the price of copper 100 years ago. This did not seem an unreasonable query, but the oldest member of our staff could not remember, and we were unable to find the information in any of the reference books to which we customarily resort in such cases. The inquirer has, however, rooted out the information, and we are publishing it as a matter of record. Our own copper production did not reach 100 tons yearly until 1845, so British prices for this period are standard.

PRICE OF COPPER IN ENGLAND FROM 1800 TO 1831*

Years	Average Standard Price per Long Ton £	s.	d.	Equivalent Cents per Lb. (£1 = $4.86)
1800	133	3	6	29
1801	117	5	0	25
1802	110	18	0	24
1803	122	0	0	26
1804	138	5	0	30
1805	169	16	0	37
1806	138	5	0	30
1807	120	0	0	26
1808	100	7	0	22
1809	143	12	0	31
1810	132	5	0	29
1811	120	12	0	26
1812	111	0	0	24
1813	115	7	0	25
1814	130	12	0	28
1815	117	16	0	26
1816	98	13	0	21
1817	108	10	0	23
1818	134	15	0	29
1819	127	10	0	28
1820	113	15	0	25
1821	103	0	0	22
1822	104	0	0	23
1823	109	18	0	24
1824	110	0	0	24
1825	124	4	0	27
1826	123	3	0	27
1827	106	1	0	23
1828	112	7	0	24
1829	109	14	0	24
1830	106	5	0	23
1831	100	0	0	22

The price in those days, it will be observed, was not much different from what it is now, although we presume that a dozen eggs could have been purchased for 5d; so copper probably seemed high. The mines in Cornwall gradually increased their ore production from about 56,000 long tons in 1800 to 144,000 in 1831. The ore was rich, too—7 to 10 per cent copper.

*From M'Cullock's "Practical, Theoretical and Historical Dictionary of Commerce and Commercial Navigation"; 1847. Vol. 1, p. 481.

Some other statistics taken from "History of Money and Prices," 1896, by J. Schoenhof, go even further back:

PRICES OF IRON AND OTHER METALS FROM THE CLOSE OF THE SEVENTEENTH CENTURY

(In English Shillings)

	1693 to 1702	1784 to 1790	1791 to 1803	1804 to 1819	1821 to 1838	1848 to 1852
English pig iron, per long ton.	240	70 @ 120	103 @ 157	140 @ 180	114 @ 120	41 ....
Finished iron (in bond), per long ton.....	....	268	364	298 @ 380	308 @ 380	119 ....
Copper per 112 lb.....	99	80	93	143	91	87

More recent statistics covering copper prices from 1860 to 1912 were published in the *Engineering and Mining Journal* of Dec. 6, 1913.

Although saying little about prices, the following letter may prove of interest while our thoughts are in the dim and distant past:

Manchester, Eng. June 4th, 1788.

Dear Cousin John:—

We received your letter of inquiry about the mine north of Rockey Hill, N. J., U. S. A. We opened this mine in the year 1748. We worked it along up to the indepents war then Washington came to New Brunswick, then his soldiers came to the mine and ordered our men to surrender. I was there at the time our men all came out of the mine. there was a little fight between six solgers and eighteen of our miners of the solgers was killed and several of them hurt.

I will never return to America again.

I will give you a description of the mine.

The west shaft is over one hundred feet deep. We mined many hundred tons of copper ore and sent it home to Ingland, and we sold it for seventy dollars a ton on an average.

There is two large floors in this shaft. sometimes the vane is fore or five foot wide and again it narrows to one foot then widens out again to 4 or 5 foot. this is a very rich vane of copper, there is a shaft east a little north of the above shaft which is about one hundred and fifty feet distance which has a large vane of black copper in it. We worked both shafts. We left our tools in the mine. If you should get the mine will you let me know.

Yours Affectionately,

Good By (Signed) J. G. George

The account of the battle between the "solgers" and miners is no worse than a great many others which we have read.

Armenian Mineral Wealth

The Department of Mines of the Armenian Republic, in a report on the minerals of that country, states that Armenia was the cradle of metallurgy, and that there are hundreds of abandoned mines in the country, and numerous ruins of forges and foundries. The mining industry of Russian Armenia is represented by twenty-two copper-ore, rock-salt, and iron-pyrites enterprises, eighteen of which exploit old mine workings. There are seven copper smelters. The average annual production during the years 1911, 1912, and 1913 was 154,900 tons of copper ore, 10,000 tons of iron pyrites, and 6,614 tons of copper metal. The Russian-Armenian production of copper before the war was 26 per cent of the total production of Russia.

Men of Note in the Mining Industry

Colonel William Boyce Thompson

A RECITAL of the achievements of William Boyce Thompson suggests a composite biography of several great men. How could one man do so much before his fifty-second year? The answer is simple—work. This explanation is like that of the prestidigitator who says, "Ladies and gentlemen, the quickness of the hand deceives the eye," and leaves his audience as mystified as before. "The outstanding characteristic of Colonel Thompson," said one of his intimates, "is his capacity for work. His evenings are usually spent on work of some kind." With this recipe, therefore, for reaching the top, the young aspirant may go his way, bearing in mind that what is meant is the kind of work that gets results of the right kind. There it is in a nutshell. And the results? Colonel Thompson is to be credited with the success of Inspiration, Magma, and Nevada Consolidated, of which no mining man need be told. Less well known is the fact that he was mainly responsible for daylight saving, having put Senator Calder up to this parsimonious piece of business in the first place. His title of colonel dates from the war, when he was commissioned a lieutenant colonel and sent to Russia as a member of the Red Cross Commission, of which he later became head. He had been actively backing the Belgian Relief work before this, and it was through his efforts that the Rocky Mountain Club, of which he was vice-president, postponed the erection of a costly clubhouse, that the funds might be used to aid war sufferers abroad.

COLONEL WILLIAM BOYCE THOMPSON

New York's prominent men, more often than not, were born outside of the city. Some of them came originally from Brooklyn and other Eastern points. Thompson comes from Montana. To go back to the beginning, he was born in Virginia City, in that state, in 1869, his father having followed prospecting, mining, and lumbering on his own account. His education was received at Phillips Exeter, in New Hampshire, and at the Columbia School of Mines. Then came a few years of knocking about his native state, in which he learned more of the ins and outs of mining. At the age of twenty-nine he headed again for the metropolis, determined to sit in the big game. He came with little cash and lots of nerve, and before long his ability as an organizer was evident. When the Utah Copper project was launched, Thompson, believing in D. C. Jackling, backed his faith with money and reaped a corresponding reward. His ability was signally recognized by the metropolitan business interests, when, in 1914, he was elected a director of the Federal Reserve Bank of New York. From this position he resigned last December, upon his appointment as chairman of the ways and means committee of the National Republican Committee. He is also president of the Roosevelt Memorial Association. Colonel Thompson's schemes are big. Nothing else seems to attract him. One of the more recent ones, of which comparatively little has been published, is the mineral exploration work in China which engineers representing him have undertaken. Another project, now under way, is the prospecting and development of the huge Flin Flon ore deposit, in northern Manitoba, in which he is engaged, together with his associates. In all his dealings he will have facts and not theories, and goes to heavy expense, if necessary, to determine them. On this trait undoubtedly rests his success. Two P's, patience and persistence, are said to be his mottoes, and in his successful handling of the Inspiration project these characteristics may readily be discerned.

Although Colonel Thompson has amassed great wealth, this has not been his object. Apparently it is the fun of playing the game, rather than the reward, that attracts him. Having brought Inspiration to successful production, he disposed of the property to Anaconda.

He has given largely. While in Russia he dug heavily into his own fortune to combat the German propaganda that was designed to draw that country from the war. His interests aside from business are varied. He is seen now as a collector of minerals, now as an exhibitor at the flower show. He belongs to several clubs. All things considered, Colonel Thompson gets a great deal out of life.

BY THE WAY

A Chance for the Reno Station

A map in process of being made, which shows the occurrences of minerals in the United States, has been submitted to the U. S. Geological Survey, with the request that it be criticized, particularly as to "the occurrences of alimony and manganese." At the Survey it is stated that neither its field researches nor statistical inquiries have been expanded to cover the subject of alimony, although during the war period they did considerable work in determining the extent of the nation's antimony deposits.

Anybody Lose This?

"Yellville, Ark.—Gus Young, an ore buyer and real estate man of this place, found the remains of a fragment of a meteror several days ago near the Winchester mine on the Buffalo River in Searcy County. He and Tobe Woods, a lawyer residing at Marshall, Ark., were going through the woods when his attention was attracted to a burned area some six feet in circumference. Upon examination he saw a strange stone lying buried to a depth of six inches in the center of this area, and upon picking it up found it to be a fragment of a meteror. The fragment resembles a big cinder, much the same as are taken from base burners, with the exception that it is highly glazed on the surface and some iron can still be seen in its composition. In bringing it home it became broken in three parts. When first discovered it was 18 in. long, 8 in. in circumference at the head, and tapered to a tail."

Put to the Test

C. C. Norton, president of the Jazz Cat Oil Co., is going to wash his hands completely of W. E. Stephens, according to the *Verde Copper News*, unless the latter immediately disproves the charge that his "vibratile motion instrument" is a fake when it comes to testing for the presence of oil. Unless he does this forthwith, Mr. Stephens is going to lose the golden opportunity of testing the Verde Valley, in Arizona, for oil for the Jazz Cat company. "Stephens must present some positive proofs or we shall have nothing to do with him," says Mr. Norton. So there, Mr. Stephens, get busy with that vibratile motion instrument of yours.

Why Boys Leave Home

Down in the Oklahoma and Kansas sections of the Joplin-Miami zinc and lead district many of the mining men live either in Joplin or Miami and, finding it inconvenient to go home every day, spend all but the week-end at the mine. Idle time in the evenings has naturally led to various diversions, including the indoor national game, mostly at a small limit. A stranger in the district, however, who had heard interesting tales about these evening games, had occasion not long ago to visit a mine office in the Kansas section, northwest of Picher, in the evening, and found seven of the boys seated around a table. Much to his astonishment, however, he found that they were playing pitch a nickel on the "corner." "First thing you know you boys will get to be gamblers," he commented, whereat there were protestations from the players that they were only passing the time away. About a week later the same visitor had occasion to visit the same office and again found the same boys gathered around the table, pasteboards in hand. He expected to find that the stakes had been raised decidedly, having had some experience in such things. Instead he found that the game of pitch and the regulation playing cards had been eliminated entirely, and the boys were playing "Rook" and entirely for the fun of it, not a cent being ventured. While he was there one of the leading players, the ground boss at the property, threw down his cards and quit, declaring: "I've got to cut this out; it's growing on me. First thing I know I won't want to do anything else." And he withdrew from the game.

Nothing But the Truth

This story looks too open-faced to be new, yet is told in sober earnestness by an Arizona mining engineer: A party of sightseers had been taken, of an evening, into one of the mines at Globe, Ariz. As the visitors were being hoisted, one of the ladies exclaimed: "It has been a wonderful trip. I feel that we should come again in daylight, when we can see things so much better."

It Is Hard To Please

The following letter was sent to us from Chile by a company that had received it from a disgruntled prospector. We find it quite idiomatic:

In regards to that telegram of 15th I thought i would receive something of that sort, Because I dident like the way that Man you call an Engineer took Samples he dident go into the Earth he Scratched on top like a hen Now? you or any entelegant man ought to know when water hits gold it will part from anything but the solid rock on those Veines is exposed to the Sun the Rock will Powder he took only on the very top the *peones* or me was to take samples we would go at least one to two meters in depth, him no on the very top of the earth. As to my crosscut I wanted to go one meter in depth he said he dident have time nor money enough what do you think of that he took what I was cleaning off to find the *guier*[1] and said that was enough the *peones* laughed at him & said that wasant nothing atall but he was paying the men so I couldant say any thing we cleaned off the *guier* with a bar no wedges nor a hammer we just got the hole cleaned out that isant no time to take samples. You have to open up the work you cant piek up gold on the floor of the hole he was only 3 days on the mine where he ought to have been at least 15 days; I AM NOT AT TALL PLEASED WITH HIS WORK ATALL It isant Justes for you or me. I like Engineer tall slim man I dont know his name a man about 45 years of age that man knows his business; but this other has been in the air to much[2] to know much a bout Gold mines he says let me have the pan I am goine to the river to get samples what do you think he brought back it was colores he said it was Pure Sand OXIDE OF IRON stain he calls it gold color the man must be simple Simon I can figuer the Compy Out. I am going out to the mine & get some samples for you that you will be proud of all that stoughf he took i would be a shamed to get souch stough i would expect to get fired at once; or say I dident get to the mine i took sick or something because he had good *guier* I will say that much But i gave him that myself when you find good *guier* you will find good Gold that is Rich *guier* but the gold you cant expect to get gold on the hanging wall do you no nor any body else I want Justes as you do neither one has yet got Justes, hoping to here from you soon.

Respectfully Yours, C. MURPHY.

[1]The word *"guier"* above should be spelled *"guia,"* which is Spanish for "stringer" or "veinlet."

[2]The reference to the engineer having been too much in the air probably is related to the fact that he was in the U. S. Air Service during the war.

CONSULTATION

U. S. Platinum Deposits and Production

"Are there any mines regularly producing platinum in the United States, or is the metal purely a byproduct in the recovery of other metals? I realize that the domestic production is very small."

Crude platinum in 1919 was produced mainly by the gold dredges operating along the foothills of the Sierra Nevada as a byproduct from gold recovery. The total United States production was estimated by the U. S. Geological Survey at 824 troy ounces, a record production in recent years, in spite of its relative smallness, and the largest output since 1906, which was 1,439 oz. Domestic production in 1913, 1914, 1915, 1916, 1917 and 1918, was 483, 570, 742, 750, 605, and 647 oz., respectively. Most of the 1919 output came from California, but Boss Mine, Clark County, Nev., produced some platinum- and palladium-bearing copper ore, which was shipped to Eastern refiners for treatment. The Rambler Mine, Albany County, Wyo., also made a recovery of platinum and palladium from similar ore. The Salt Chuck mine, in Kasaan, Alaska, described in a previous issue of the *Engineering and Mining Journal*, was a producer of very rich ore.

As to other localities which are potential platinum-producing areas and which have produced in the past, there might be mentioned the placer gold fields of Butte, Yuba, Calaveras, and Stanislaus counties, Cal., where the platinum is derived mainly from the Mother Lode country's serpentine areas. Other platiniferous localities are in Nevada County, and in the Klamath Mountains in Trinity, Siskiyou, Humboldt and Del Norte counties.

In southwestern Oregon, the stream placer deposits of Josephine, Curry and Coos counties have been known to carry platinum. Beach placers in Curry and Coos counties have produced some of this metal. The Blue Mountains of northeastern Oregon, in Grant and Baker counties, have been sources, particularly near Sumpter. Utah and Washington have also reported the discovery of platinum, but the production has been unimportant.

The Customs Tariff on Metals

"Will you please inform me what the duties on the metals copper, lead, zinc, nickel, quicksilver, and antimony are?"

The customs duties on these metals, according to the Customs Tariff Act of 1913, are as follows:

Copper in ores, matte, bars, ingots, pigs, regulus, plates, scrap and composition metal is admitted duty free. Manufactured copper forms carry a duty of from 5 to 20 per cent.

Lead ores command a duty of ¼c. per lb. of lead contained. Lead in bars, pigs, granules, bullion, alloys, iron, hard metal, old scrap lead, and refuse (lead content taxable) commands a duty of 25 per cent. Lead pipes, sheets, shot and wire, white lead (dry or in oil), and red lead also carry the same duty.

Zinc slabs, blocks or pigs and old zinc suitable only for remanufacture, 15 per cent duty; zinc-bearing ores (on zinc content) 15 per cent; zinc dust, sheets not polished or plated, 15 per cent; zinc oxide, 10 per cent.

Nickel in ore, matte, or other crude form, free; nickel in alloys, pigs, plates, ingots, bars, and oxide, 10 per cent; nickel in sheets and strips, 20 per cent.

Quicksilver commands a duty of 10 per cent.

Antimony ore is admitted free; metal and regulus, 10 per cent; antimonial type metal, 25 per cent; antimony containing 10 per cent lead, 10 per cent.

Lead Mining and Refining Companies

"I have been trying to secure the addresses of the lead companies in the United States that are both miners and refiners of lead, and have been referred to you for the information. I will be very grateful if you can have the addresses sent me or tell me where I will be able to secure them."

Lead companies in the United States that are both miners and refiners of lead are given in the following list:

American Smelting & Refining Co., 120 Broadway, New York. (Subsidiary companies all over the United States.)

American Metal Co., 61 Broadway, New York. (Has several subsidiary companies.)

Bunker Hill & Sullivan Mining & Concentrating Co., 1,022 Crocker Building, San Francisco. (Smelting company is a subsidiary.)

St. Joseph Lead Co., 61 Broadway, New York.

Anaconda Copper Mining Co., 42 Broadway, New York. (Controls subsidiary lead companies.)

U. S. Smelting & Refining Co., 120 Broadway, New York. (Controls subsidiary lead companies.)

Eagle-Picher Lead Co., Joplin, Mo.

American Zinc, Lead & Smelting Co., 55 Congress St., Boston, Mass. (Controls a subsidiary lead company.)

Northport Smelting & Refining Co., Northport, Wash. (Controlled by Hercules Mining Co., in Burke, Idaho, and Tamarack & Custer Mining Co., Wallace, Idaho. The bullion is refined by the Pennsylvania Smelting & Refining Co. at Pittsburgh.)

National Lead Co., 111 Broadway, New York. (Controls a subsidiary.)

Geophone Manufacturers

"In referring to your article "Military Mining in France," in *Engineering and Mining Journal* of March 6, 1920, showing in the frontispiece a soldier using the geophone, kindly let me know where in the United States I can get a geophone and what would be the price of it."

The instrument is finding increasing commercial application, which supplements its chief use in rescue work in underground mining operations. Thus the geophone has been successfully used in detecting leaks in water mains and locating underground water courses. The manufacturers claim that knocks in automobile valves and cylinders have also been located with the aid of the instrument. An important use in mining work for which the geophone is peculiarly adapted is checking underground surveys designed to connect drifts, raises, and other workings.

The Globe Phone Manufacturing Co., of Reading, Mass., manufactures the instrument and can furnish prices for the different styles.

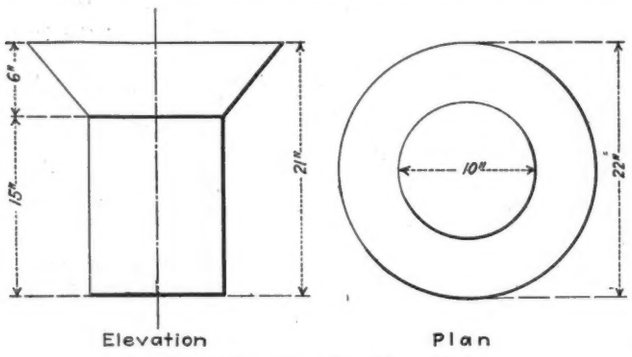
HANDY KNOWLEDGE

Another Method of "Holding the Sack"

BY LEROY A. PALMER

Written for *Engineering and Mining Journal*

I was much interested in the description of a device for holding a sack while filling it with ore which appeared in a recent issue of the *Engineering and Mining Journal*, but the type of funnel shown in the accompanying sketch, which is the design of one used for sacking concentrate at the Plymouth Con-



FUNNEL FOR FILLING SACKS

solidated mine, in Amador County, Cal., in my opinion, has it beaten.

Dimensions may be varied, of course. Those shown give the cylindrical portion a capacity of 100 lb. of ore which weighs 4,000 lb. per cu.yd. when broken.

In use, the sack is slipped over the funnel and the latter is stood on the floor, when the sack naturally slips down over the cylindrical part and rests on the floor while the funnel is being filled to the proper point. When filled, the sack is held up with one hand while the funnel is lifted out and the ore runs into the sack as it is being removed. Or, the mouth of the sack is taken in both hands, grasping the lower end of the cylinder at the same time, so that sack and funnel may be lifted at the same time and the ore run from the funnel to the sack.

The funnel is made of moderately heavy sheet iron, which may or may not be galvanized, according to the conditions to be met.

Motor Haulage Switch Protection

BY T. H. ARNOLD

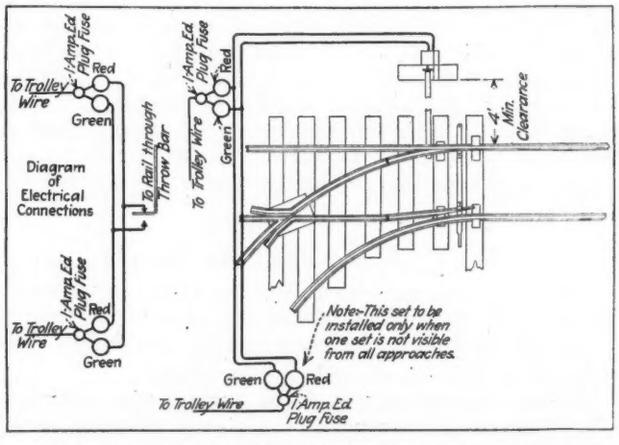
Written for *Engineering and Mining Journal*

The customary railroad switch stand lamp, turned with the operation of the switch, has not proved adaptable to underground mining conditions. A visible indication of the switch position is a necessity from a safety standpoint. This also expedites the handling of trains on the motor haulage. To meet these conditions, several electrical devices were tried out, all depending upon the operation of various forms of electric switches controlled by a bar attached to the movable switch points, this operation causing a red or green lamp to burn, depending upon the position of the switch.

The first form of lamp unit was simply two weather-proof sockets hanging from the mine timbers. The sockets were connected on one side directly to the trolley wire and the other side through the switch to the track. Thirty-five watt, 250-volt carbon lamps were used, the lamps being dipped in red or green lamp coloring. As the maintenance is rather high, and the lamp color faded rapidly, these have been superseded by a more satisfactory type, with three cleat receptacles mounted on a piece of 20-gage galvanized iron. The common wire of two receptacles carried through the third, which has a 3-amp. Edison plug fuse for protection. This wire then goes to the trolley. Two wires are carried through the switch to the track.

Twenty-five-watt, 250-volt mill type Mazda lamps have been substituted for the 35-watt carbon lamps, and color caps have been substituted for the dipped lamps with beneficial results, as the lamps are more visible and the color distinctions more positive. Also the color does not fade. A considerable saving is made in kw.-hr. consumption. As one lamp burns at each switch twenty-four hours a day, and thirty days per month, the saving on seventy-two switches will amount to 518 kw.-hr. a month. The life of the lamp is approximately double that of the carbon lamps, which will pay for the difference in cost of the two lamps.

The form of switch now being adopted is built up of two automatic door switches, one of the opening, and one of the closing, type. The plunger is spring-loaded to allow a possible movement of an inch and a half on the bar from the switch; the door switches require exactly ½-in. total movement. These switches are enclosed in a substantial iron box and can readily be



WIRING DIAGRAM FOR MOTOR HAULAGE SWITCH PROTECTION

mounted in place of the older types. They are safe from shock by accidental contact, and will withstand considerable moisture and rough handling.

It is also customary to mount a 120-watt carbon lamp directly over each switch, on the lagging between the caps. In this way the caps cut off the direct light in the motorman's eyes. These lamps are being superseded by the 50-watt mill-type Mazda lamps with the tungsten filament.

THE PETROLEUM INDUSTRY

Physical and Chemical Data on Colorado Oil Shale

Results of Recent Work by Government Investigators on the Density, Heat of Combustion, Thermal Conductivity, Analyses, Specific Heat, and Oil Yield of a Representative Sample of Massive Rock

BY MARTIN J. GAVIN AND LESLIE H. SHARP*

Refinery Engineer, U. S. Bureau of Mines, and Chemical Engineer, State of Colorado, respectively

INVESTIGATIONS of the oil shales of Colorado were begun on Feb. 1, 1920, by the U. S. Bureau of Mines and the State of Colorado, under a co-operative agreement entered into by the Bureau and the state, funds for which were provided by the state. The investigations are for the purpose of determining, by large-scale laboratory retorting tests, those conditions which will produce optimum yield of best quality products from Colorado shales. (For an outline of the work and description of the apparatus, see Gavin, Martin J., and Sharp, Leslie H., "Investigations of the Fundamentals of Oil-Shale Retorting," Reports of Investigations, Bureau of Mines, July, 1920.)

In the preliminary work which is usually required when a new material is being dealt with, certain physical and chemical constants of the shales being investigated, and their products, were determined. These data will be of much value not only to the thorough retorting tests now under way at Boulder, but to engineers who will design and construct oil-shale plants. Although the figures presented in this report apply only to the shale used in the determinations, strictly speaking, the shale used was selected to represent, as well as possible, an average of the massive type of oil shale occurring in Colorado. The figures, therefore, can probably be applied with little danger of serious error to any massive Colorado oil shale which yields approximately a barrel (42 gal.) of oil to the ton.

SCOPE OF THE WORK

The following data were obtained on a representative Colorado oil shale:

1. Weight per cubic foot of different sizes of shale.
2. Apparent specific gravity.
3. Specific heat of raw and spent shale.
4. Heat of combustion of raw and spent shale.
5. Thermal conductivity of raw shale.
6. General analyses.
7. Oil yield.
8. Heat of combustion of crude shale oil.

The above-noted factors were determined for the oil shale obtained from De Beque, Col., which is being used in the retorting investigations. This shale is of the massive variety, and on laboratory tests yields oil of 0.905 specific gravity at the rate of 42.7 gal. to the ton (2,000 lb.). In addition, the specific heat was determined on a sample of oil shale from the Parachute Creek district, Col., as an indication of the order of variation of this factor in shales of the same approximate richness from different localities.

*Excerpt from U. S. Bureau of Mines, "Reports of Investigations."

DATA OBTAINED

The following data were obtained as a result of the work:

1. Oil yield, 42.7 gal. per ton.
   (Method, Bureau of Mines assay retort.)
2. Specific gravity of oil, 0.905 (24.7 deg. Bé.) at 15.56 deg. C. (60 deg. F.)
3. Weight per cubic foot (Method, direct weighing).

Size	Weight, Lb. per Cu.Ft.
Run of mine	53.775
Plus 1 in.	54.775
Minus 1 in.	56.015
Minus ¼ in.	58.200

4. Apparent specific gravity of raw shale, 1.92 to 2.06.
   (Several specimens from large sample.)
   (Method, weight in air divided by loss of weight when immersed in water.)
5. Specific heat, (average of several closely agreeing determinations.)
   (Method, method of mixtures, Studentia calorimeter.)
   Specific heat, raw De Beque shale..... 0.265 mean 20-90 deg. C.
   Specific heat, raw Parachute Creek shale..... 0.242 mean 20-90 deg. C.
   Specific heat, spent De Beque shale..... 0.223 mean 20-90 deg. C.
6. Heat of combustion.
   (Method, combustion in oxygen in Emerson calorimeter.)
   Heat of combustion, raw De Beque shale, about 2,460 calories per gram.
   Heat of combustion, spent De Beque shale, about 600 calories per gram.

The determination of the heat of combustion of raw and spent shales cannot be considered entirely satisfactory. Except in one or two determinations with the raw shale, it was impossible to obtain complete combustion even when using oxygen at 500-lb. pressure in the calorimeter bomb. In no test was it possible to obtain complete combustion of the spent shale in the bomb. Both the physical appearance of the ash taken from the bomb and the fact that various residues lost 2 to 6 per cent, in the case of the raw shale, and 13 to 15 per cent in that of the spent shale, indicate that combustion was incomplete.

In two instances samples of raw shale were completely burned in the bomb, and showed no further loss on subsequent ignition. These two determinations indicated the heat of combustion of the shale to be 2,432 and 2,486 calories per gram, respectively. As regards the spent shale, the heat of combustion was calculated by making a rather arbitrary correction on the basis of the loss on ignition of the residue after combustion in the calorimeter. There is little scientific justification for making such a correction, but the fact that the figures obtained on several determinations agree so closely probably makes it worth while to present the results obtained. Indications are that the heat of combustion varies somewhat even between carefully taken

samples of the same lot of shale. It was not considered advisable to spend any additional time on more carefully determining these figures at present, as it was intended merely to show that spent shale and even raw shale probably could not be considered satisfactory fuel for direct combustion. Later it is hoped that modifications in the method can be worked out which will permit the practical operator to obtain accurate and trustworthy results in this regard.

7. Thermal conductivity.
Thermal conductivity, De Beque raw shale, range 25 to 75 deg. C., 0.00382. (Method, Forbes method, giving absolute conductivity.)

8. Analytical data

De Beque Raw Shale	Sample 1 Per Cent	Sample 2 Per Cent
Loss at 110 deg. C. (moisture)	0.60	0.59
Loss on ignition	40.00	39.70
Ash or residue	59.40	59.71
Totals	100.00	100.00
Ash Analysis		
Silica (SiO_2)	44.70	45.10
Iron and alumina (Fe_2O_3 and Al_2O_3)	25.60	26.35
Lime (CaO)	17.65	18.35
Magnesium (MgO)	5.28	5.35
Undetermined	6.77	4.85
Totals	100.00	100.00

9. Heat of combustion.
Heat of combustion, crude shale oil, 10,215 calories per gram. (Method, combustion with oxygen in Emerson calorimeter.)

Comparative Values

The following tables are presented for the purpose of comparing various physical and chemical data on oil shale obtained in the present investigation with similar data on other more familiar substances.

TABLE I. DENSITY AND WEIGHT PER CUBIC FOOT OF VARIOUS SUBSTANCES

Material	Grams per Cu. Centimeter (Density) *e*	Pounds per Cubic Foot (in Place) *d*	Authority
Massive Colorado oil shale	1.92–2.06*c*	119.8–128.5	Present work
Anthracite coal	1.4 –1.8	87 –112	Smithsonian Inst.
Bituminous coal	1.2 –1.5	75 – 94	Smithsonian Inst.
Clay	1.8 –2.6	122 –162	Smithsonian Inst.
Coke	1.0 –1.7	62 –105	Smithsonian Inst.
Limestone	2.68–2.76	167 –171	Smithsonian Inst.
Peat	0.84	52	Smithsonian Inst.
Sandstone	2.14–2.36	134 –147	Smithsonian Inst.
Petroleum	*a*. 878–9.65*b*	*a*54.8–60.2*b*	Smithsonian Inst.

a At 16 deg. *b* At 0 deg. C. *c* The determined density of a material depends on its state (especially if porous), and its previous treatment, i. e., whether air dried, how long, and at what temperature. The method used in this work gives apparent density (grams per cubic centimeter), but, from the nature of the material used, this figure is undoubtedly close to the true density. *d* Obtained by multiplying density by 62.4. *e* Ordinary atmospheric temperature is understood.

Table II presents specific heats of raw and spent oil shales as determined in the present investigation, compared with specific heats of other materials.

Specific heat of a substance is the ratio of the amount of heat measured in calories required to raise the temperature of one gram of the substance 1 deg., to the amount of heat required to raise the temperature of 1 gram of water 1 deg C., at a specified temperature. The specific heat of a substance varies with the temperature of the substance.

TABLE II. SPECIFIC HEATS OF VARIOUS MATERIALS

Material	Specific Heat	Mean Temp., Deg. C. *a*	Authority
Massive De Beque, Col., oil shale	0.265	20–90	Present work
Massive Parachute Creek, Col., oil shale	0.242	20–90	Present work
Spent De Beque, Col., oil shale	0.223	20–90	Present work
Sandstone	0.22	.....	Smithsonian Inst.
Limestone	0.216	15–100	Morano
Granite	0.192	12–100	Joly
Asbestos	0.195	20–98	Ulrich
Clay, dry	0.22	20–100	Mean of several
Wood	0.42	.....	.....
Gas coal	0.3145	20–1040	Smithsonian Inst.

a At 16 deg. C.

Table III presents the heats of combustion of the raw and spent shale and crude shale oil in comparison with average figures for well-known fuel materials.

TABLE III. HEATS OF COMBUSTION OF VARIOUS SUBSTANCES

Material	Heat of Combustion — Calories per Gram	Heat of Combustion — B.t.u. per Pound	Authority
Massive De Beque, Col., oil shale	2,460*a*	4,428*a*	Present work
Spent De Beque, Col., oil shale	600*a*	1,080*a*	Present work
Bituminous coals	6,088– 7,852	10,958–14,134	Smithsonian Inst.
Anthracite coals	6,987– 7,417	12,577–13,351	Smithsonian Inst.
Lignite coals	3,526– 3,994	6,347– 7,189	Smithsonian Inst.
Coke	7,000	12,600	Smithsonian Inst.
Fuel oils (heavy)	10,200–10,500	18,360–18,900	Smithsonian Inst.
Peats (air-dried)	4,867– 5,726	8,761–10,307	Smithsonian Inst.
De Beque shale oil (sp. gr. 0.905)	10,215	18,387	Present work
Fuel oil (light), (sp.gr. 0.903)	10,710	19,280	Wadsworth

a Approximate values as already mentioned.

Table IV presents the thermal conductivity of De Beque, Col., massive oil shale, and various other good and poor heat conductors.

Thermal conductivity, "*k*," is the heat in gram calories flowing in one second through a plate 1 centimeter thick, per square centimeter, for 1 deg. C. temperature difference between faces of the plate. "*K*" is found to vary with the absolute temperature of the plate.

TABLE IV. HEAT CONDUCTIVITIES FOR VARIOUS SUBSTANCES

Material	K	Temp., Deg. C.	Authority
Copper	0.918	18	Jaeger & Diesselhorst
Copper	0.908	100	Jaeger & Diesselhorst
Iron, cast	0.108	18	Jaeger & Diesselhorst
Iron, cast	0.108	100	Jaeger & Diesselhorst
Lead	0.083	18	Jaeger & Diesselhorst
Lead	0.076	100	Jaeger & Diesselhorst
Iron, wrought	0.144	18	Jaeger & Diesselhorst
Iron, wrought	0.142	100	Jaeger & Diesselhorst
Carborundum brick	0.0032 to 0.027	150–1200	Wologdine
Magnesia brick	0.0027 to 0.0072	50–1130	Wologdine
Silica brick	0.002 to 0.0033	100–1000	Wologdine
Fireclay brick	0.0032 to 0.0054	125–1220	Wologdine
Firebrick	0.00028	.....	Hutton-Blard
Firebrick	0.00109	100	Barratt
Limestone	0.0046 to 0.0057	40	Poole
Limestone	0.0039 to 0.0049	100	Poole
Limestone	0.0032 to 0.0035	350	Poole
85 per cent magnesia asbestos	0.00017	Mean 10–500	Randolph
Oil shale (De Beque, Col.)	0.00382	Mean 25–75	Present work
Oil shale (De Beque, Col.)	0.00518	Mean 25–40	Present work
Oil shale (De Beque, Col.)	0.00314	Mean 40–75	Present work

General chemical analyses of oil shales ordinarily have little value except in comparison with other shales. Analytical figures may serve to indicate the fusibility of the shale ash and its possible utilization for brick or cement making and the like. In comparison with analyses of other oil shales, the Bureau of Mines is attempting to use analytical data, especially data having to do with loss on ignition (volatile and fixed carbon), as an indication of possible oil yield and the analyses of shale ashes as a means of classifying shales by districts and as possibly influencing the quality of oils recovered from the various shales.

Table V shows the difference in composition of mineral matter (ash) of shales from different localities. It also indicates the relationships between volatile and fixed carbon and oil yield.

TABLE V. ANALYSES OF OIL SHALES FROM VARIOUS LOCALITIES

Source of Shale	Ash Analysis — SiO_2	Fe_2O_3 and Al_2O_3	CaO	MgO	Volatile and Fixed Carbon	Oil Yield, Gallons per Ton *c*
De Beque, Col. *a*	44.70	25.60	17.65	5.28	40.0	42.7
Elko, Nev. *b*	65.5	25.5	0.6	0.8	33.5	32.5
Dragon, Utah *b*	45.8	16.4	23.9	7.9	42.2	41.6
Dragon, Utah *b*	46.8	17.5	23.9	8.9	34.3	21.7
Green River, Wyo. *b*	38.9	12.4	38.3	4.9	34.9	23.4
Green River, Wyo. *b*	41.9	18.8	17.6	10.9	48.1	58.7
Kentucky *b*	52.0	19.1	12.5	8.2	29.3	18.2
Ione, Cal. *b*	43.0	38.1	8.7	2.5	62.9	52.0
Casmalia, Cal. *b*	75.8	19.1	1.4	0.9	*d*	18.0

a Present work. *b* T. B. Brighton, analyst, unpublished work, Bureau of Mines, Salt Lake City. *c* Laboratory assay. *d* Not determined.

NEWS FROM THE OIL FIELDS

Deepest Gulf Coast Well Produces From 3,700 Ft.

From Our Special Correspondent

Several important completions have been made recently in the Gulf Coast fields. At West Columbia, in Brazoria County, Tex., the No. 1 Hogg well of the Gulf Production Co. came in, making 700 bbl. from a depth of 3,700 ft. This is probably the deepest producing Gulf Coast well. At Humble, the Sun Co. has struck oil on Lot 11 of Block 2, Riverside addition, at 3,200 ft. In the old Barber's Hill field, Chambers County, the joint well of the United Petroleum Co. and G. C. Smith et al. came in, making about 700 bbl. from 1,900 ft. Previously, the production from this field had been gradually decreasing. Now there is considerable leasing, and at least two other companies will drill again. Two good wells were also completed at Hull, Liberty County, one a 1,500-bbl. well of the Republic Production Co. and the other a 300-bbl. well of the Phoenix Development Co. The production of the Hull field has been increasing gradually for the last few months. The famous No. 1 Abrams well of the Texas Co. at West Columbia, which has been decreasing in its former rate of flow, suddenly stopped flowing for five hours early Sept. 5th. It was sanded, and the insertion of a flow pipe caused the flow to resume. The rate was not given.

Gas was turned into the mains from the Amarillo gas field on Sept. 4th. It is stated this field can supply 500,000,000 cu ft. of gas daily.

It is believed a large gas field will be opened south of Burkburnett and adjoining the Texhoma field. Recently, J. I. Staley completed a well at 1,450 ft. having a gas flow of 7,000,000 cu.ft. This is the third large gas well completed in an area of four or five square miles.

In Eastland County a development of importance in the southern part is the discovery of oil in quantity in the Caddo lime. Previously this formation was considered dry in most places, and wells were drilled right on through it. The Pittsburgh Western Oil Co., however, shot its Pruett well, south of Carbon, at about 2,300 ft. and obtained a good producer. Later the Atlantic Oil & Refining Co. developed a flow of 1,000 bbl. in one of its wells to the southwest of the Pruett well by shooting at 2,400 ft. Many wells that were drilled through this stratum may be plugged back and shot in an effort to get production from this lime.

Two gas blowouts are reported in the Pettus well of the Goliad Oil Co., near Goliad, Goliad County. These occurred at 2,700 ft. Whether this will be an oil producer cannot be determined until casing is set.

Market Arranged for Louisiana Natural Gas

From Our Special Correspondent

According to a recent report at a special session of the New Orleans commission council held on Sept. 1, 1920, a fifty-year lease to supply that city with natural gas was granted certain interests, not named, represented by W. E. Wren, of Minden, La., and W. A. Trimpe, of Houston, Tex. The franchise grants to the new company the right to lay gas mains and distributing pipes under the streets, but does not exclude the present company now supplying artificial gas. Work of installing mains must begin within twelve months from the time of acceptance of the franchise, and six miles of mains must be laid within a year from that date. The price of gas is fixed at 65c. per 1,000 cu.ft. for domestic use up to 6,000,000 cu.ft. daily, and when the consumption exceeds that figure, 50c. per 1,000 cu.ft. Other clauses limit the minimum of B.t.u. contained in the gas and provide for artificial gas in case of failure of the natural-gas supply, and payments to the city for the franchise based upon the consumption. The supply of natural gas, it is stated, has been acquired, but its source is not yet made public. It is probable, however, that it will come from the big gas field a few miles south of Houma, Terrebonne Parish.

The American Oil & Drilling Co. has started drilling on the J. J. Thompson plantation two miles from Opelousas, St. Landry Parish. An area of 8,000 acres has been leased.

Drilling will be done near Church Point, Acadia Parish, where W. G. Morgan has a mineral lease on 9,000 acres. In 1903 the Crowley Oil & Development Co. brought in a small oil well near here.

The Detroit Oil & Gas Co. will drill for oil on its recently acquired lease in Iberia Parish about four miles west of New Iberia. The rig for this work has been received.

Gas Coming Through Salt Water at Holbrook, Ariz.

From Our Special Correspondent

Rising through 700 ft. of salt water, gas that will burn is coming from the Adamana well in Arizona. The bore has been stopped at 2,140 ft. for casing, in fear that a big gasser will be developed. For several hundred feet the drill has been passing through alternating strata of sandstone, limestone, and rock salt, the log being similar to that of the Hopi well, now blocked by lost tools at 2,500 ft. depth. The Holbrook well, now down 1,600 ft., is to be driven to 3,000. Zuni is down 400 ft.

Warren County, Kentucky, Has Another Gusher

From Our Special Correspondent

A gusher was brought in at 225 ft. on Sept. 3 on the farm of Mrs. J. W. Stone, Warren County, Ky., adjoining the General W. L. Sibert gusher. It is estimated at 1,800 bbl. daily production.

The Richpond Oil Co., operating in Warren County, reports two good wells on the John W. Phelps lease, estimated at 140 bbl. each. They were brought in at 395 and 450 ft. The company has started No. 3 and 4 on the Frank Holland lease. A 100-bbl. well is reported on the Skiles lease situated along the Smallhouse Pike. This is considered a new pool. The oil was of a light grade.

The Hugh Potter well on the Bailey lease, Warren County, owned by the Whittle Oil Syndicate, is pumping 150 bbl. a day.

Butler County, northwest of Warren, is looked upon as a possible extension of the oil fields, following the recent discovery of oil at Gilstrup. A company of farmers and business men, after drilling 1,250 ft. without success, struck oil sand with a flow of gas. The well will be sunk deeper. Another wildcat test will be made soon.

Several good wells have been brought in in the Merba pool, Menifee County. No. 1, on the Shelby Palmer lease, has been completed. A location for No. 2 of the same operator has been staked out on the Edgar Smallwood farm. Several companies are resuming operations in this field. Indications are that it will equal Lee and Wolfe, other central-eastern counties of Kentucky.

Oil men are giving attention to Clinton County following a strike at Beach Bottom. This well reached a showing of oil at 1,735 ft., with small quantities of oil for 40 ft. The driller estimates it as good for about 50 bbl.

Montana Has 2,000-Bbl. Gusher

From Our Special Correspondent

Well No. 2 of the Frantz Corporation, a subsidiary of the Elk Basin Consolidated, was brought under control recently after it had spouted unrestrained for more than a week at the rate of around 2,000 bbl. daily, with a flush production of 3,000 bbl. at one time, it was estimated. As many men as could be obtained were busily engaged in throwing up dirt dams to impound the oil. For the grade of oil, which runs up to 50 per cent gasoline, the Frantz well is said by oil men to stand out for volume among the foremost producers in the country. Piping of the oil from the well to Winnett, Mont., a distance of about twenty miles, began last week, the oil being shipped to the Elk Basin refineries in Wyoming.

COURT DECISIONS IN MINING CASES

By Wellington Gustin

Federal Title to Mining Claim Confirmed

North American Transportation & Trading Co. Loses Appeal Against the United States—Was Awarded Value of Claim at Time of Taking by Government

The Supreme Court of the United States has affirmed the judgment of the U. S. Court of Claims in the suit brought by the North American Transportation & Trading Co. in the Court of Claims in 1906 to recover the value of a placer mining claim situated on the public land near Nome, Alaska. It was alleged this mining claim was taken by the United States in 1900. General Randall, of the United States Army, commanding the Department of Alaska, took possession, as a site for an army post, of a large tract of public land which included the mining claim. The tract has been used as an army post continuously since possession was first taken by General Randall. The buildings erected thereon are situated on that portion of the land which had been the company's placer claim, so that the company has not been able to operate.

The court said that when the government, without instituting condemnation proceedings, appropriates for a public use, under legislative authority, private property to which it asserts no title, it impliedly promises to pay for same.

The company claimed $100,000 from the United States, alleged to be the value of the mining claim, and the further sum of $7,500 per annum for the use and occupancy of said claim from 1900. The court of claims found the value of the mining claim when it was taken to have been $23,800, and an award therefor was given the company. The loss of this use for nearly twenty years was due to the company's delay in prosecuting its suit, the Court of Claims having no power from Congress to allow interest. This award was sustained as correct.

"Unless Lease" Valid

An "unless lease" for oil and gas exploration and development purposes was the subject of a suit in equity brought by E. L. Brunson and others against the Carter Oil Co. in the United States District Court for the Eastern District of Oklahoma.

Judge Williams, in deciding the case for the oil company, held that such an exploration "unless lease" for oil and gas, for which the lessee paid a substantial bonus, with a privilege of renewal of the lease by payment of a substantial sum annually, was a valid mutual contract based on a valuable consideration, and not subject to forfeiture because of failure to make an annual payment in time to a grantee of lessor, where it was in fact made before due, but through mistake of a clerk in failing to make proper entry of transfer of title on the records of the lessee the payment was sent to lessor, instead of to his assignees.

An "unless lease" was considered in another case where the court said: "It would seem to me that a lease of this character, the lessor receiving valuable consideration for the privilege of exploration for oil, would confer a valid right of exploration for the time and on the terms spoken of in it. Such would seem to be the intent of the parties and the justice of the matter, notwithstanding the contract imposed no obligation on the lessee to drill or pay. The lessor has been paid his price for giving such privilege."

Must Consummate Transaction To Earn Commission

Broker Loses Suit Against the Esperanza Mining Co. and Guggenheim Exploration Co. for Sale of Mexican Mining Property

In the suit of Dennis B. Harris against the Esperanza Mining Co. and the Guggenheim Exploration Co. to recover commissions amounting to $202,500, alleged to have been earned by Brad Barnar by procuring the sale of a Mexican mining property, the New Jersey Court of Chancery dismissed claimant's bill, upholding defendant's contention that Barnar was not the "procuring cause of any sale" of the property in question.

The defendant Guggenheim Exploration Co. alleged that it never purchased the mines of the Mexican company, but that a syndicate composed of the said defendant, an English corporation known as the Venture Co., Ltd., and a firm of brokers of London, England, known as L. Hirsch & Co., as the transferees of an option held by one E. A. Wiltsee, purchased from various individuals a majority of the capital stock of the Mexican corporation, in good faith and for a valuable consideration, namely $3,000 in Mexican currency for each share of stock, and that this price was paid without the knowledge that Brad Barnar or his assignee had any claim for commissions.

The court said that where negotiations between the parties introduced by a broker had terminated without a sale, the fact that the prospective purchaser subsequently acquired an interest in the mines by employing as its manager one who had acquired an option on the property as the result of negotiations independent of the broker does not entitle the broker to a commission.

Washington Statute Does Not Authorize Use of Second-Class Tidelands

In Seattle, Wash., Warren Stetson applied for a writ of mandamus to require the Commissioner of Public Lands to execute to him a lease for mining and extracting petroleum and natural gas from certain tidelands belonging to the State of Washington. The commissioner had refused to execute the lease on the ground that tidelands are not lands within the meaning of the state statute, Sections 6,791 and 6,792.

Though the Supreme Court of Washington held that tidelands are "lands belonging to the state," it would not interfere with the action of the commissioner in refusing to execute lease of unsurveyed tidelands for extraction of petroleum and natural gas under the above sections of the law authorizing the leasing of such lands, "not to exceed one section," though the application for a lease described the land affected as "containing 640 acres," as the area of the described land has not been ascertained and cannot be determined by any mathematical process from the description contained in the application. This results from the fact that there was no official or state survey of second-class tidelands in the State of Washington.

Mineral Reservation Exempts Operator From Negligence in Mining

In the action taken by Atherton against the Clearview Coal Co. for negligence in the mining of coal, the property of the company, underneath the surface of land owned by the complainant, the Supreme Court of Pennsylvania held that the mineral reservations in the deed exempted the owner of minerals from liability for negligence in mining.

The exception, or reservation, contained in the deed of the surface of the land to Atherton, reserved the right to mine and remove all coal and minerals beneath the surface, with the right to mine and remove the same by any subterranean process, without liability under any circumstances for damages done to the surface or improvements erected thereon.

The court said such reservation was sufficiently broad to include liability for negligent mining, and there could be no recoveries for injuries to buildings from improper blasting, for the intention of the parties to the deed of conveyance, as shown by the language used, must govern in the interpretation of the written instruments, and it is apparent all liability was excluded.

ECHOES FROM THE FRATERNITY

Super-Power Survey Committee To Report June 30, 1921

W. S. Murray and Assistant Engineers Making Critical Examination of Country's Power Resources and Conservation

A committee representing the engineers of the United States appeared before the Appropriations Committee of the House of Representatives last April to urge the necessity of a careful survey of our natural-power resources, with a view to securing more efficient generation, transmission, and use of electricity. W. S. Murray, consulting electrical engineer of New York City, who had charge of the electrification of the N. Y., N. H. & H. R.R., had outlined a Super-Power System which offered definite plans for eliminating the economic waste of our present power arrangements, and Congress was urged to contribute to the necessary expenses of a proper preliminary power survey of the country.

Public interest and opinion were sufficiently strong to secure favorable action from both houses of Congress, and $125,000 was appropriated to finance an administrative and engineering force that will show clearly in its report (a) the points where present wastes are occurring and (b) the design of a regional system which would eliminate these wastes, for a zone 150 miles deep along the Atlantic seaboard between Boston, Mass., and Washington, D. C. W. S. Murray is naturally chairman of the engineering staff of the Super-Power Survey, as this organization is called, and its headquarters are at 709 Sixth Avenue, New York City.

As organized, this investigation under W. S. Murray's chairmanship is divided into the three departments of power and transmission under L. E. Imlay; railways under Cary T. Hutchinson; and other industries under Henry W. Butler; all three assisted by the engineer-secretary, Henry Flood, Jr., who will collaborate in the collection of field data and preparing the data for the report. N. C. Grover, chief hydraulic engineer of the U. S. Geological Survey, and O. P. Hood, chief mechanical engineer, U. S. Bureau of Mines, are also collaborating with the staff of the survey.

Every two months from now until April 30, 1921, the chairman of the engineering staff meets an advisory board under the chairmanship of Prof. L. P. Breckenridge, of Yale, presents the progress of the work and discusses with the board his program for the next two months. This advisory board is designed to secure the counsel of men representative of power producers, consumers and the interests of the people in a national power policy, and properly embraces eminent representatives from all these classes, such as E. G. Buckland, vice-president N. Y., N. H. & H. R.R.; Magnus W. Alexander, National Industrial Conference; Henry W. Butler, consulting engineer, New York City; the Secretary of the Interior; the Director of U. S. Geological Survey; and others.

The final report of the Survey will be made June 30, 1921, and the responsibility for taking further action will rest on the Congress. As a recent editorial in *Power* very truly said:

"This undertaking is not alone of particular interest to those living along the North Atlantic seaboard, but to the entire country. Railway congestions in this district did not alone affect the industries located in this region but practically the entire nation. Consequently, the Super-Power Survey, at present under way, merits national support."

Iron Trade Control Association of Germany

Acting Commercial Attaché Henry F. Grady reports from The Hague, Netherlands, that by a decree of the German National Government, dated April 1, 1920, there was established for the control of the iron trade an autonomous body with legal standing called the "Eisenwirtschaftsbund" (Iron Trade Control Association) with headquarters at Duesseldorf. A translation of this decree may be consulted at the Bureau of Foreign and Domestic Commerce, Washington, D. C., on referring to file No. 42075.—*U. S. Commerce Reports.*

Ontario Mining Association held its first annual meeting at Sudbury, Ont., Aug. 17 to 19. Among the important matters considered was the position of iron-ore mining in Canada. The association appointed R. W. Leonard, A. J. Young and G. S. Cowie as a commission to assist the provincial and dominion governments in any possible study of Canada's iron-ore industry.

The South African Institution of Engineers awarded its gold medal for 1918-1919 to Henry S. Potter, member of the institution, for his paper, "Hammer Drills: Their History, Design and Operation," published in the Journal of the Institution, Vol. 17, Nos. 4, 5 and 6. The Central Mining-Rand Mines award for the same season was made to T. H. Bayldon, also a member of the institution, for his "Notes on Experiments Made With a View to Reducing the Consumption of Explosives and Increasing the Fathoms Broken Per Machine Shift in Machine Stoping," published in the same journal, Vol. 16, No. 12.

Mining Standards Committee Urged by Mining Congress

Would Not Compete With Existing Bodies, Says W. R. Roberts—Invitations Being Issued to Denver Conference

The American Mining Congress has undertaken to organize a nation-wide movement for the standardization and improvement of mining practice as it pertains to mining machinery and equipment, cost accounting, safety codes, life- and time-saving devices, and co-operative methods.

At an informal conference in Chicago on Aug. 30 between officers of the congress and representatives of the American Engineering Standards Committee, the National Safety Council, the American Institute of Mining Engineers, and the U. S. Bureau of Mines, a resolution was adopted requesting the American Engineering Standards Committee to at once organize a mining standards committee composed of members selected by the bodies represented in the informal conference.

"It is not the intention of this committee to in any way duplicate the work of existing bodies," said Col. Warren R. Roberts after the meeting. "There will be no competition and no friction. The American Mining Congress represents the industry because it is composed entirely of operators, and hence, is the industry. We intend to take up and consider all of the standards that have been or may be suggested or adopted by either the Government or by voluntary organizations, and to make these standards operative and profitable. We will also propose such changes and new standards as our committee, by experience and contact with the actual conditions in the mines, believes would be of value or necessity. The standardization conference in Denver during the annual meeting of the American Mining Congress in November will be, I believe, one of the most important meetings ever held, and its influence will be felt permanently in both mining and manufacturing. Among the most necessary things to be developed is to show how standardization has made possible wonderful progress in other lines; and how the coal men have materially strengthened their business standing by recent adoption of standardized accounting, without which they might have suffered many embarrassments during the strikes and wage conferences."

The official invitation now being prepared is signed by Colonel Roberts, chairman of the general committee on the standardization of coal-mining machinery; Charles A. Mitke, of Bisbee, Ariz., and Richard A. Parker.

Engineering Council Experience Guided F. A. E. S.

Organizing Conference Recognized Successes and Limitations of the Council—Plans a Broader and More Effective Body

In connection with the Federated American Engineering Societies two questions have arisen:

1. "If Engineering Council is a success why should the proposed federation supplant it?" and

2. "If Engineering Council is a failure why should the Federation be organized along lines so nearly parallel?"

These are basic questions and worthy the serious consideration they have received, not only from the joint conference committee when it was preparing its report, but also from the committee on constitution and by-laws of the Washington organizing conference.

When the joint conference committee, composed of conferees of four of the then five member societies of Engineering Council, considered the question of co-operation of these societies in matters of common concern to the engineer, the functions and accomplishments of Engineering Council naturally came under review. There were present as conferees three members of Engineering Council, and by invitation of the committee Council also had an official representative present.

The committee decided that some form of comprehensive organization was necessary to provide a medium that could speak for the engineering and allied technical professions on matters of common concern to them. The committee also decided, which decision was concurred in by the official representative of Engineering Council and the members of the committee who were also representatives on Engineering Council, that

"If desired, Engineering Council can be moulded into this organization by making it more democratic and founding it on direct representation of all engineers, rather than by appointment as at present."

It was agreed that Engineering Council is at present not properly constituted to carry on efficiently the work which it has undertaken; its organization is from the top downward, rather than from the bottom upward, which the committee deemed desirable if a thoroughly representative and efficient organization was to be established.

It has been admitted by Engineering Council, and it was so pointed out to the members of the joint conference committee, that Engineering Council has been handicapped from the beginning in regard to funds for its operations, in freedom of action on the matters that came before it, by reason of the necessity for reference to the member societies and to the United Engineering Society, and the great difficulty in electing additional member societies. The annual contributions of the member societies never exceeded $22,000; which amount was wholly inadequate for meeting the demands for service which Council has been desirous of rendering.

Despite these difficulties, Engineering Council has been able to accomplish a great deal, as was pointed out by the joint conference committee in Bulletin No. 3, and particularly has it been successful in its work of developing among its member societies the habit of united effort in matters of common concern to the engineer and the allied technical professions. Engineering Council may be said to be a success, and considering the conditions under which it has operated, to be a commendable success. It is evident, however, that basic defects in its organization prevent Engineering Council fulfilling the real functions of a comprehensive body representing the engineering profession, and these defects are not remedial through reorganization.

Engineering Council has six member societies. At the organizing conference in Washington 71 societies were represented, with an aggregate membership of over 80 per cent of all the individuals represented by the 110 societies invited.

Engineering Council Approved Action of Conference

The action of the organizing conference in creating the Federated American Engineering Societies and its governing board, American Engineering Council, was unanimous. This action has received the unanimous approval and support of Engineering Council. The affirmative consideration that is being accorded the invitation to become members of the Federated American Engineering Societies insures that American Engineering Council will have a far greater number of member societies at its initial meeting in November than Engineering Council, based on its present rate of growth, could possibly have had under existing conditions at the end of many years.

The work of Engineering Council is not to be abandoned, but is to be carried on and extended under a more comprehensive program made possible by the more representative American Engineering Council.

The deficiencies of Engineering Council are not in the quality of the work that it has accomplished, but rather have been due to its organic limitations and to the fact that it is not sufficiently representative of the local, state and regional organizations and affiliations. The organizing conference in Washington laid the foundation for a more democratic organization in which the local, state, regional engineering, and allied technical organizations and affiliations will be represented and have a real voice in its management.

The organizing conference in its wisdom recognized the successes and limitations of Engineering Council and has evolved an organization in which all of these successes will be utilized and a broader opportunity afforded for more effective work on behalf of the engineering and allied technical professions.

Harding and Cox Answer Queries Put by A. A. E.

Candidates State Positions Concerning Department of Public Works, Conservation and the Budget System

In reply to the following questions, drafted at the recent annual convention of the American Association of Engineers,

1. Are you in favor of a National Department of Public Works, for the purpose of reducing and co-ordinating the present number of bureaus and commissions, and reducing the useless expenditures of money incident thereto?

2. Are you in favor of assembling and co-ordinating all the engineering and construction enterprises of the Government (excepting the purely military works) in a department such as the National Department of Public Works, to the end that economy and efficiency will be obtained?

3. Do you favor the appointment of an engineer of recognized ability and unimpeachable character as a member of the Interstate Commerce Commission?

4. Do you favor a progressive and constructive program of conservation and development of our natural resources?

5. Do you favor the budget system of appropriation of public funds?

6. Do you favor the reclamation of waste lands by drainage, irrigation, flood control or other methods?

Do you favor giving the settler the advantage of procuring the land by a sound financial system such as is provided by a rotating fund?

the following letters have been received:

State of Ohio.
Executive Department,
Columbus
August 13, 1920.

Mr. L. K. Sherman, President,
American Association of Engineers,
63 East Adams St., Chicago, Ill.

My dear Mr. Sherman:

My reply to every one of the questions you ask is unequivocally "Yes."

Time will not permit, nor do I consider it proper, that I answer the ordinary questionnaire. My past record and public utterances must be sufficient. However, as in the case of your letter, the reply to questions asked and my record and public announcements are one and the same. I therefore take great pleasure in making this statement.

With every good wish, I am,
Very truly yours, JAMES M. COX.

Marion, Ohio,
August 9, 1920.

Mr. C. E. Drayer, Secretary,
American Association of Engineers,
63 East Adams St., Chicago, Ill.

My dear Mr. Drayer:

Your letter to Mr. Christian of Aug. 4 has been brought to my attention.

It is not an easy matter for me to make a detailed reply to the inquiries conveyed in your letter, and I do not care to enter into a categorical reply to questionnaires, no matter how friendly they may be and no matter how reputable and high-standing is the source from which they come.

My theory of a campaign is, that a man's candidacy ought to be based on the formal and public utterances, though, of course, we are all of us informal enough to discuss informally many of the problems which are in the minds of various groups of our American citizenship.

I have had up the matter of the Department of Public Works in some personal interviews, and quite agree with you that the question is an exceedingly interesting and important one. I fear I should be unworthy of public confidence if I ventured to decide so important and far-reaching a question without the very fullest study. It involves the reorganization of several departments. Undoubtedly, there is necessity for this, but I should be very reluctant to unalterably commit myself to it without the very fullest of understanding.

You may be interested to know that I have already sent for the Congressional hearings on this particular question.

I may say, in a general way, that I think very well of the appointment of an engineer on the Interstate Commerce Commission and I have always spoken heartily in favor of a progressive and constructive program of conservation. I am sure you know that I favor the budget system and a very forward policy relating to reclamation and irrigation.

Very sincerely yours, W. G. HARDING.

Book Reviews

South African Engineers' Directory. Compiled and published by *The South African Mining and Engineering Journal,* 176-180, Stock Exchange Building, Johannesburg. Cloth, 6 x 10, pp. 422. First edition, 1920. Price, 30s.

This directory is the only one of its kind covering that part of the world, and embraces every branch of the engineering, electrical, iron, steel, machinery, hardware, and allied trades throughout the Union, Rhodesia, and Mozambique. One section gives an alphabetical list of all firms, with such data as postal and telegraphic addresses, names of the partners or directors, agencies represented, capital, and other details. Another section gives the names arranged geographically. Another is a list of about 1,000 overseas manufacturers and their South African representatives. A buyer's index of factories and firms selling various classes of merchandise is followed by what will probably be of most interest to our readers, a list of the mining and industrial companies, with the names and addresses of both major and minor officials. An alphabetical classified list of engineers and mining officials is also given. The book is very complete, and those who know South Africa tell us that it is also exceptionally accurate.

Statistical Abstract of the United States, 1919. Cloth; 6 x 9; pp. 864. For sale by the Superintendent of Documents, Washington, D. C., for 50c.

There is an old saying to the effect that figures don't lie but liars can figure. This book affords plenty of material, as it contains nothing but statistics, although a volume of almost 900 pages. For those whose requirements extend beyond such tomes as the "World Almanac," this should be a very valuable book.

Technical Papers

Clay.—Bulletin 58 of the Iowa State College Engineering Experiment Station, Ames, Iowa, tells of the possibilities of pottery manufacture from Iowa clays. Those who have clay deposits in other parts of the country can get from this bulletin information as to the uses of various kinds of clay and methods of testing.

Fuel Oil.—Oil fuel is cheaper per heat unit than coal in most parts of the United States. It also has many advantages. How to change over to oil, in boilers previously equipped to burn coal, is described in a three-page article in the Aug. 14 *Electrical World* (New York, 25c.).

Magnesite.—The U. S. Tariff Commission (Washington, D. C.) has issued a twenty-eight-page pamphlet entitled "Information Concerning the Magnesite Industry," which gives data on the grades and uses, sources of supply, mining and calcining methods, costs, and competitive marketing conditions. This country consumes normally one-half of the world's output, and before the war 90 per cent of the domestic supply was imported, chiefly from Austria and Greece. A slightly ferruginous magnesite is required for metallurgical purposes. Pure domestic ores are satisfactory only if iron is added, which has been generally done.

Pulverized Coal.—Joseph F. Shadgen has a four-page article in the Aug. 19 *Iron Age* on the science of powdered-fuel combustion, including reference to thermic fundamentals, effects of various air quantities on temperature and gases produced, the ash problem, and burner essentials. Previous articles by the same author were, "The Status of the Powdered-Fuel Problem," in the Jan. 1 issue of *The Iron Age;* "Methods of Pulverizing Coal," in the issue of Feb. 5; and "Pulverized Coal Distributing Systems," in the issue of May 20.

Mining in Quebec.—"The Report on Mining Operations in the Province of Quebec During 1919" (free, from the Department of Colonization, Mines and Fisheries, Quebec, Que.) will be of especial interest to those engaged in the asbestos and magnesite industry, for those minerals, along with copper and sulphur ore, are Quebec's chief mineral products. The asbestos industry flourished during the last year, but the value of magnesite produced was only about one-quarter that of 1918.

Selling a Prospect.—The editor of the *Arizona Mining Journal* has a four-page article in the August number (price 20c., Phœnix, Ariz.) on how a prospector or owner should go about interesting capital in his property. Some of the things the exploration engineer wants to know are outlined.

Graphite.—In the *Canadian Mining Journal* (Gardenvale, Que., 15c.) for Aug. 20 is a four-page article on the past and present methods of concentrating graphite ore. Flotation is now commonly used, but the problem is rather one of proper grinding. The "perfect process" of M. J. Paterson, mentioned on the page preceding the article, seems to have received scant attention.

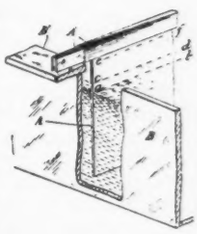
Porphyry Copper.—A history of the past activities and an illustrated description of present conditions at the mines of the Copper Canyon Mining Co. cover six pages in the Aug. 15 issue of the *Salt Lake Mining Review* (Salt Lake, Utah, 15c.). This property is seven miles southwest of Battle Mountain, Nev., and promises to be a large producer of the "porphyry" type.

Clay.—The Bureau of Mines has issued Technical Paper 233, "The Properties of Some Stoneware Clays" (pp. 41). This gives the results of a study of the properties of some Ohio and Pennsylvania clays. Obtainable from the Superintendent of Documents, Washington, D. C., for 10c.

Recent Patents

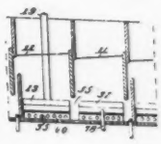
1,347,189. Recovery of Zinc by Electrolysis. Royale Hillman Stevens, assignor to Electrolytic Zinc Co. of Australasia Proprietary, Ltd., Melbourne, Victoria, Australia. Filed Nov. 11, 1919.

In the electrolytic process for the recovery of zinc, providing a protective coating for the cathode above the normal solution level by first carrying out a preliminary electrolysis with the cathode immersed to substantially a line immediately below the supporting bars, the cathodes having wooden strips affixed at or about the normal solution level which prevent the deposition of zinc under them, and then removing the said strips and proceeding with the electrolysis in the ordinary way in cells with the solution at normal level, whereby the subsequently deposited zinc strips along the line of weakness at or about the solution level.



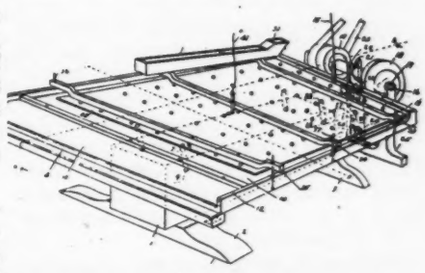
1,346,818. Flotation Ore Separator. Rudolf Gahl, Miami, Ariz., assignor, my mesne assignments, to Pneumatic Process Flotation Co., New York, N. Y. Filed Jan. 31, 1916.

A flotation ore separator comprising a receptacle having an impervious bottom, means for supplying ore to be treated to said receptacle, and means for removing concentrates therefrom, said receptacle having located near the bottom thereof a series of independently removable foraminous air chambers having longitudinally extending upper surfaces, said air chambers being arranged for travel of substantially the whole of the pulp over the series.



1,347,026. Apparatus for Extracting Metal From Ores and the Like. Harold H. Godfrey, Los Angeles, Cal. Filed Aug. 4, 1919.

An apparatus for extracting metal from ore including an ore concentrating shaking table inclined longitudinally and transversely, said table being covered with a cathode, and an anode spaced above said cathode.



MEN YOU SHOULD KNOW ABOUT

J. B. Tyrrell, of Toronto, Ont., has gone to Newfoundland on professional business.

C. W. Cooke has completed several months' geological work in Colombia, and is again in the United States.

J. B. Harper, of Jerome, Ariz., who was recently visiting New York on professional business, has returned to Jerome.

D. E. Winchester has completed an extended field study of oil shales, and now is engaged in writing his report thereon.

John Sterling, chief inspector of mines for Alberta, is in Scotland for a rest after his serious illness during the summer.

Harry J. Wolf, of New York City, has completed mine examinations in southeastern Arizona and has gone to Denver, Col.

Harold Kingsmill, of New York, stopped in Salt Lake City Aug. 25 for a short stay while returning East from Eureka, Nev.

Robert N. Bell, retiring state mine inspector of Idaho, will take over and operate the Clayton mine in Custer County, Wash.

K. C. Heald, of the staff of the U. S. Geological Survey, is inspecting the work being done by Survey geologists in Western oil fields.

Paul Liver, of Wallace, Idaho, was elected president and manager of the Giant Mining & Development Co. at the annual meeting.

Roy L. Barns, of the Solvay Process Co., sailed for France on Sept. 9. He will study alkaline deposits in Belgium, France, and England.

W. W. Risdon, of Albuquerque, N. M., has been appointed as the New Mexico state inspector of coal mines, to succeed the late **J. E. Sheridan.**

Y. Fukihara, mining engineer, of Tokyo, Japan, is visiting mines in the United States on his way home from an extended visit to England.

J. Carlton Bray recently made a professional examination of the Nevada Western Gold & Silver Mining Co. property near Pyramid Lake, Nev.

F. M. Manson and **Morris P. Kirk** are inspecting mining properties in the Lordsburg, N. M., district, and also in the Chiricahuas, in Cochise County, Ariz.

K. S. Twitchell, mining engineer of San Francisco, Cal., sailed this week for a trip of several months in Europe. Most of the time Mr. Twitchell will devote to France.

William H. Crague, metals specialist, and **Raymond Richards**, oil specialist, have been appointed tax-valuation engineers in the income-tax unit of the Bureau of Internal Revenue.

Charles E. Knox, president of the Montana-Tonopah Mining Co., Tonopah, Nev., was among those present at the beginning of operations of the Gold Canyon Dredging Co., of Dayton, Nev.

S. F. Shaw, of Charcas, San Luis Potosi, Mexico, has resigned from the American Smelting & Refining Co., to become manager of Cia. Minera La Constancia, at Sierra Mojada, Coahuila.

W. A. Funk has recently returned from Colombia, South America, where he was in charge of the Chicago mine in the Guamoco district. Mr. Funk will resume his practice as a mining engineer, at Idaho Springs, Col.

Angus W. Macdonald, employment agent of the companies of Dominion Steel Corporation, and recently superintendent of Black Diamond Coal Co. at Lethbridge, Alberta, has been appointed superintendent of industrial relations by the corporation.

WILLIAM SPENCER MURRAY

William Spencer Murray, consulting engineer of New York City, author of the Super-Power System, chairman of the Super-Power Committee and of its engineering staff, was born in Annapolis, Md., in 1873, and was graduated in electrical engineering from Lehigh University in 1895. After seven years of practical training with the Westinghouse Electric & Manufacturing Co., he engaged in four years of consulting practice in Boston. After this Mr. Murray, in 1905, became chief electrical engineer of the N. Y., N. H. & H. R.R., and took full charge of the great task of carrying out the electrification of the New Haven. He was president of the Housatonic Power Co. in 1917-18, and a member of the electrical engineering firm of McHenry & Murray from 1913 to 1917, and vice-president of the A. I. E. E. from 1913 to 1914. His experience in large-scale electrical engineering undertakings has logically led to his conception of a nation-wide survey of our power system and to his selection, by Secretary Payne, to execute the restricted survey as authorized by the last Congress.

Walter H. Wiley, of Los Angeles; **Fred Searls, Jr.**, of Berkeley, and **Albert Burch**, of San Francisco, Cal., all retained by the Hecla Mining Co. in the pending apex litigation with the Federal Mining & Smelting Co., were recently in Wallace, Idaho, in connection with that case. They were accompanied by John P. Gray, chief attorney for the Hecla.

Recent visitors to New York included the following engineers and mining men: Emilio Mosonyi, Salvador Deep Well Boring Co., San Salvador, C. A.; P. R. Hines, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.; L. A. Barton, Shreveport, La.; Everett W. Smith, Roasting & Magnetic Concentrator Zinc Co., Ltd., Montauban, Que.; F. F. Kett, San Francisco, Cal.; Courtenay de Kalb, Baltimore, Md.; William F. Jahn, El Salvador silver mine, Gilman, Mont.; Charles C. Selbie, of Pasadena, Cal., and Dundu, Caixa 347, Loanda, Angola, Africa; F. J. S. Sur, San Antonio, Tex.; Dr. E. Barth, Roswell, N. M.; A. Matsuhara, Kyoto, Japan; K. S. Twitchell, Los Angeles, Cal.; H. C. Anchor, Dome Extension Mines, South Porcupine, Ont.

SOCIETIES

American Mining Congress, holding its twenty-third annual convention at Denver, Col., Nov. 15 to 20, invites all manufacturers of mining machinery, all engineers, all mine operators, their officials, and all others interested to the **First National Standardization Conference.** This conference, meeting on the dates mentioned in the Albany Hotel, Denver, will discuss the improvement and standardization of mine practice as applied to mining equipment, machinery, labor- and life-saving devices, safety codes, costs accounting, government and state co-operation, and related subjects. The first annual joint meeting was at St. Louis in 1919, and the standardization committees have now divided their work into two general divisions, Metals and Coal. Address all inquiries to John T. Burns, assistant secretary, American Mining Congress, Albany Hotel, Denver, Col.

National Safety Council has issued the preliminary edition of the program of the **Ninth Annual Safety Congress** to be held in the Auditorium, Milwaukee, Wis., Sept. 27 to Oct. 1, inclusive. That week is also to be "No Accident Week" for Milwaukee. The Mining Section begins its sessions on Sept. 28 at 2:30 p.m. and includes papers on Vocational Training, Industrial Nurses, Safety Devices on Hoisting Engines, Handling Mine Cars, Gas Explosion Prevention, Hazards in Open-Cut Mining, by C. A. Mitke, L. F. Mitten, D. E. A. Charlton, and others. Headquarters will be at Hotel Wisconsin, 3d St. near Grand Ave. J. C. Pinney, 108 Mason St., Milwaukee, Wis., will attend to requests for hotel reservations.

THE MINING NEWS

LEADING EVENTS

National Tax Association Meets in Salt Lake City

Various Plans of Taxation Discussed by Delegates—Utah Copper Workings at Bingham Visited

The National Tax Association recently met in Salt Lake City, the place of meeting being the Hotel Utah. The question of a plan of taxation to take the place of the tax on stock dividends under the head of excess profits tax refused by the supreme court was discussed on Wednesday, Sept. 9, when it was announced that treasury officials are seriously considering the imposition of a tax on undivided earnings. John E. Walker, special attorney for the Internal Revenue Bureau, speaking for his chief, T. S. Adams, who was unable to be present, said that Mr. Adams was giving much thought to this form of taxation, combined with an extension of special excise taxes on commodities sufficiently in common use to yield a considerable revenue to take the place of that which the supreme court decision placed out of the reach of the Federal officials.

At the close of the evening session, Prof. Charles M. Bullock, of Harvard, at the round table discussion spoke in opposition to the proposed form of taxation, saying that it would place larger corporations in a more favorable position and work hardship on newer and smaller enterprises. Meyer D. Rothschild of New York, chairman of the business men's national tax committee, speaking for the proposed plan, held that the little business men would be in rather a better position than at present. Thomas W. Page, chairman of the U. S. tariff commission, opened the evening session by giving an outline of the history and work of the commission, now four years old, describing also the chaotic condition of commercial relations between countries following the world war.

A paper by Prof. R. M. Haig, of Columbia University, was then read by A. E. Holcomb on "The Exemption of Mortgage Interest as a Solution of the Housing Problem," stating that real estate stands to lose more through such a policy than any other interest, as any breakdown in income taxation would throw the burden back on realty. A report adopted unanimously by the committee on exemptions was read by Prof. Carl C. Plehn, of the University of California. This report urged "that there should be no privileged class free from bearing their share of the cost of the institutions upon which their well-being, if not their lives, depended."

Douglas Sutherland, of the Illinois constitutional convention, gave an account of taxation problems in his state. On the afternoon of Sept. 9 members, after a morning session given over to round table discussion, were taken to Bingham as the guests of the Utah Copper Co., where they were shown about by John M. Hayes, treasurer of the company, who explained the pioneer work of D. C. Jackling in bringing to commercial use low-grade porphyry ores.

WEEKLY RÉSUMÉ

It is reported from California that the Rising Sun Mining Co., at Colfax, has found the rich ore shoot lost years ago. At Salt Lake City the National Tax Association convened during the week. In Nevada, the Gold Canyon Dredging Co. has begun its operations. Virginia City, on the Comstock, has experienced a strike of miners. Word is received from Melbourne that the Electrolytic Zinc Co. has acquired the Mount Reed and Roseberry mines, in Tasmania. At Hill City, S. D., the National Tin Corporation has suspended operations.

Little of note is reported from Washington. Work is to be undertaken by the Bureau of Mines looking to the improvement of drill steel.

Lake Ore Shipments in August Pass Last Year's Figures

Iron-ore shipments from the head of Lake Superior are now 3,200,000 tons greater than at a similar date in 1919, shipments during August, 1920, having exceeded those of August, 1919, by 3,500,000 tons because of the coal dock strike which so seriously curtailed ore shipments during that period last year. At this writing shipments have practically ceased over the D. M. & N. on account of a strike of wipers and hostlers at the Proctor shops. The men are not employees of the railroad, but are hired by a contractor to whom the railroad company sub-lets that phase of its work. The men are now paid 50c. an hour for a twelve-hour day and are striking for 60c. an hour and time and one-half for over eight hours. A compromise of 55c. has been offered, but has not been accepted. Below are detailed figures of 1919 and 1920 shipments:

	August, 1919	August, 1920
D. M. & N., Duluth	1,645,788	2,351,918
D. & L. R., Two Harbors	847,944	1,444,926
C. & N. W., Ashland	302,305	1,101,991
Soo, Ashland	72,940	225,303
Soo, Superior	171,743	251,596
N. P. Superior	67,644	93,895
G. N. Superior	700,710	1,921,023

Unloading and loading ore carriers at lower lake ports have greatly improved and fleet capacity in the ore trade has been more than maintained in spite of increased coal shipments which have been made.

Comstock Miners Walk Out

Strike Unauthorized by Unions—I.W.W. Control Apparent—Seek Dollar Per Day Increase

Underground workers at Virginia City and Gold Hill, Nevada, walked out on Sept. 5. The strike was not authorized by the unions but was apparently organized and directed by an I.W.W. element. A mass meeting of miners was called for Sunday, Sept. 5, and on that day, at the meeting, all miners who approved the disregarding of the secret ballot and the demand for a dollar per day increase were asked to step to the right and those against to step to the left. The result was apparent approval on the part of the underground men. The "hybrid organization" then attempted to serve notice on the operators but the operators refused to recognize such notices and on Sept. 6 issued the following statement which clearly indicates the situation:

"In view of the walkout of miners of the Comstock district and their subsequent demand for a general increase of $1 per day, together with the elimination of the secret ballot, we, the undersigned operators, make the following statement of our position:

"Owing to the increased prices of mine supplies and equipment, and increased freight rates, the cost of mining has, during the past few months, been steadily climbing. On this account, and believing that a reduction in cost might be expected in the near future, many of us have been considering seriously the advisability of suspending operations in the hope of such a decrease. We have been unwilling to do this on account of the large number of men who would be thrown out of employment. By reason of this unannounced walkout the miners have settled this question for us.

"This action of the miners was taken in spite of the existence of several contracts, some of which were effective until Jan. 1, 1921, and all of which were subject to 30 days' notice before they could be nullified. In view of the absolute proof that the cost of living has already decreased and will continue to decrease, we do not feel that a raise in wages is at all warranted at this time. We are ready and willing to resume operations under the old scale of wages.

"None of the organizations represented by the undersigned operators is opposed to unionism on the Comstock.

"(Signed)

"R. A. Hardy,
"George H. Drysdale,
"H. B. Bulmer,
"H. L. Slosson, Jr.,
"Alex. Wise."

Operations at Virginia have been con-

tinued under difficulties which are not appreciated by the miners. In spite of increasing costs, efficiency has not increased and as a consequence unit costs have risen greatly. If pumps have to be pulled, as intimated, the added cost of unwatering and repairing later may operate to prevent some mines from resuming. From 300 to 350 miners are involved. Governor Emmet D. Boyle is using every effort to clear up the situation in a way that will be equitable to both parties.

Rising Sun Mine at Colfax, Cal., Finds Lost Vein

An important strike has been made by the Rising Sun Consolidated Mines Co., near Colfax, Cal. The property, which was famous about forty years ago for its rich ore, has been closed down until recently. The rich ore streak was lost years ago and much development work has been done in an effort to find the vein. Although good ore has been found it was not until Sept. 6 that the main orebody was uncovered. Crews on the 6th, 7th, 8th and 9th levels all cut the lost vein at about the same time, it is stated. The ore is free milling gold quartz, about 4 ft. wide. Some assays are said to run several thousand dollars per ton.

Mackay School of Mines Expects Good Year

The number of inquiries received from prospective students before registration day indicates that the Mackay School of Mines, connected with the University of Nevada at Reno, will have a larger attendance than ever before. It is the expressed opinion of the director, F. C. Lincoln, that the coming year will be the most successful in its history.

Mining schools at various camps in the state have been affiliated with the Mackay School of Mines, but the ones at Goldfield and Ely have been discontinued, and it is probable that the one at McGill will be also. Those at Virginia City and Tonopah will continue. A rearrangement of the mineral exhibits at the museum has been made recently and many gifts of fine mineral collections have been received recently.

The contract is expected to be let at once for the new building to house the Rare and Precious Metals Station of the U. S. Bureau of Mines, which will be in line with the east wing of the Mackay School. It will have two stories and basement and cost $30,000. The first carload of machinery to be used at the station has been shipped from Golden, Col., the former location. Charles E. Davis, of the Bureau of Mines, is now in Reno but the balance of the staff is not expected until the building is finished.

The staff of the Mackay School of Mines consists of F. C. Lincoln, director and professor of mining; J. C. Jones, professor of geology and mineralogy; and Walter S. Palmer, professor of metallurgy.

Midvale Smelter Seeks Platinum Stolen From Laboratory

166 Grams Taken Recently—Sheriff's Office of Salt Lake County, Utah, Hunting Thieves

The recovery of 166 grams of platinum stolen the night of Aug. 30 from the chemical laboratory of the U. S. Smelting, Refining & Mining Co. at Midvale, Utah, is being sought by the sheriff's office of Salt Lake County. These pieces have been listed as follows by the company:

Clyinders[1]	Numbers on Cylinders	Size of Nos. on Cylinders
1	6	1/8 in.
1	31	1/4 in.
1	25	3/8 in.
1	29	1/2 in.
1	1	5/16 in.
1	3	7/16 in.
1	5	9/16 in.
1	6	7/8 in.
1	7	15/16 in.
1	9	1/16 in.
9 Spirals		
2 Crucibles		
2 Crucible covers		
3 Filtering cones		

[1] All cylinders have "B & Co." on stem.

Weight of Platinum, grams	Size of Cylinders
17.0008	4 1/2 x 2 in.—5 5/8-in. stem
15.6973	4 1/2 x 2 in.—5 5/8-in. stem
15.4663	4 1/2 x 2 in.—5 5/8-in. stem
15.6608	4 1/2 x 2 in.—5 5/8-in. stem
11.50	3 3/16 x 2 in.—4 -in. stem
11.50	3 3/16 x 2 in.—4 -in. stem
11.50	3 3/16 x 2 in.—4 -in. stem
11.50	3 3/16 x 2 in.—4 -in. stem
11.50	3 3/16 x 2 in.—4 -in. stem
11.50	3 3/16 x 2 in.—4 -in. stem
about 6 gm.	4 1/2 in. long—1/4-in. flat coil
about 20 gm.	4 1/2 in. long—1/4-in. flat coil
about 5 gm.	4 1/2 in. long—1/4-in. flat coil
about 2 gm.	4 1/2 in. long—1/4-in. flat coil

The superintendent, E. H. Hamilton, will be glad to receive any information relating to the stolen platinum.

Joplin Zinc Producers Expected Higher Price on Slab Zinc

Zinc producers of the Joplin-Miami district have been interested in the effect of the recent freight rate increase on offerings for zinc ore and have been surprised to note that slab zinc is not quoted higher on account of it. Figures showing just what the rate increases mean for smelters buying ore in the Joplin field were recently prepared by Ross A. Blanchard, traffic manager for the American Zinc Lead & Smelting Co., and were presented by him to the Tri-state branch of the American Zinc Institute at the weekly meeting at Picher. They were as follows:

INCREASE ON ORE PER TON FROM JOPLIN DISTRICT TO VARIOUS SMELTING POINTS

	Old rate.	New rate.	Increase per ton
To St. Louis	$3.70	$5.00	$1.30
To La Salle	4.60	6.13	1.53
To Cleveland and Donora	6.10	8.35	2.25
To Fort Smith	2.40	3.25	.85
To Bartlesville	1.90	2.55	.65

INCREASE ON SLAB ZINC PER TON FROM SMELTER TO SELLING MARKET

	Old rate.	New rate.	Increase
From Bartlesville and Fort Smith	$3.53	$4.79	$1.26
From East St. Louis to Boston	7.40	0.15	2.75

When it is considered that smelters must first pay the freight on the ore and then again on the slab zinc to East St. Louis or to New York, the increased rates are decidedly important.

The Utah Power & Light Co. has been granted permission to extend its power lines through the town of Morgan in Morgan County, Utah, in order to supply power to the district beyond that place. Morgan itself is supplied by a private company, which buys the power at wholesale from the Utah power company.

New Cornelia Co-operative Store Described

Profits Distributed Among Company's Employees in Proportion to Amount of Their Purchases

E. D. Gardner, mining engineer of the U. S. Bureau of Mines, describes the New Cornelia co-operative store at Ajo, Ariz., as follows:

"The town of Ajo is built in the desert and consisted of but a few houses when the New Cornelia Copper Co. started operations. Since there were no stores at Ajo or vicinity the New Cornelia Co-operative Mercantile Co. was established to serve the needs of the employees of the New Cornelia and allied companies.

"The New Cornelia Copper Co. advanced the money to erect the store building and to buy the stock, and assumes all risks. In all, $85,000 has been advanced, representing the capital stock of the enterprise.

"The store is run by a store manager appointed by the copper company and who reports only to the general superintendent. A committee of seven workmen, representing the various departments, meet with the store manager monthly and make suggestions for the betterment of the service and present complaints which have been brought to their attention.

"The store is well managed, carries a large and well assorted stock and is modern in every respect. Prices are at the same level as in the other southwestern mining camps. The copper company does not participate in the profits of the store but does receive 6 per cent interest on the capital advanced. At the end of the year, after making proper deductions for interest on capital account, depreciation of store equipment and fixtures, and for a proper sum to the surplus account, the rest of the profits is distributed among the employees of the company in proportion to the amount of their purchases.

"To participate in the store profits employees must be in the company's employ at Christmas, when the dividend or rebate is paid, and must have worked four months previous to Dec. 20, when the books are made up.

"When a man quits he forfeits any interest in the dividend fund which he may have acquired, and it has been found that this rule promotes the stability of the working force beside reducing the cost of living of the regular employees.

"The following profits have been distributed by the store to date: 1917 (9 months) $12,052.60 to 472 employees; 1918, $32,777.71 to 773 employees; 1919, $40,825.05 to 618 employees. The average discount has been 15 per cent and about 70 per cent of the men have benefited.

"Employees, to receive the rebate, must make purchases on credit and all store accounts are deducted from pay checks. Thereby no bad debts are accumulated. The store does considerable cash business with others than employees and the profit from these purchases as well as from the business by the men who have quit the company's service, all goes into the general dividend fund.

Mine-Rescue Car Visits Engelmine, Cal.

The U. S. Bureau of Mines' rescue car No. 1, stationed at Reno, Nev., has just completed a two weeks' stay at Engelmine, Plumas County, Cal. E. D. Gardner and R. Hicox conducted classes in first aid and mine rescue for miners, foremen and superintendents of the district. The classes were held in the evening both at Engelmine and the upper mine of the Engels Copper Co.

Operations in St. Louis County, Minn., Compared

The mine inspector of St. Louis County, Minn., has submitted his annual report as of June 30, 1920. Below is a summary of the report together with a comparison with the preceding year:

	1919	1920
Number of mines operated	117	114
Number of mines idle	49	58
Total number of mines	166	172
Number of inspections	299	305
Number of men employed underground	6,552	5,898
Number of men employed in open pits	2,692	2,795
Number of men employed in stripping	2,470	2,624
Number of men employed on surface	2,498	2,804
Total number of men employed	14,212	14,121
Tons ore shipped from underground	9,575,514	7,850,590
Tons ore shipped from open pits	22,253,295	17,499,334
Total shipments	31,828,809	25,349,924
Cubic yards stripping removed	14,124,832	11,699,279
Fatal accidents underground	18	26
Fatal accidents open pit, stripping and surface	15	10
Total fatal accidents	33	36
Accident factor per 1,000 men employed	2.39	2.59
Tons ore per fatal accident	964,509	704,164
Number serious non-fatal accidents	21	36
Average wage	$5.55	$6.93

The greater part of the Mesabi Range, in the iron country, is included in St. Louis County.

Electrolytic Zinc Co. Acquires Read-Roseberry Mines

Reserves of Zinc Ore in Properties Taken Over Exceed 1,000,000 Tons —Gets Option To Buy Zeehan Smelters

From Our Melbourne Correspondent

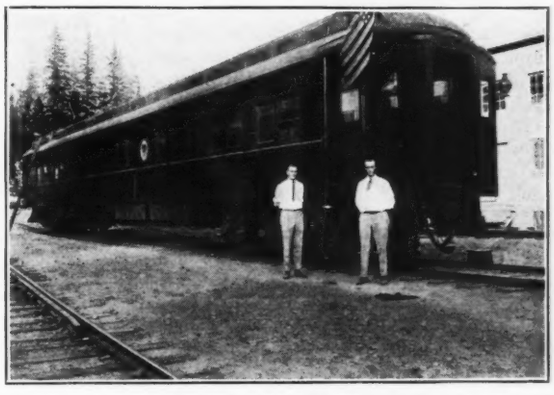
An agreement has been executed whereby the Electrolytic Zinc Co. of Australasia Proprietary Ltd. will take over as from July 31 the mines and other assets of the Mount Read & Roseberry Mines Ltd., Tasmania. The consideration for the sale is the issue to the Mount Read & Roseberry Mines of 350,000 ordinary shares of £1 each fully paid in the capital of the Electrolytic Zinc Co.; the right to the Mount Read & Roseberry mines to take up 150,000 cumulative participating preference shares of £1 each in the Electrolytic Zinc Co.; and the right of the Mount Lyell Mining & Railway Co. to appoint two directors to the board of the Electrolytic Zinc Co.

The authorized capital of the Electrolytic Zinc Co. is £1,000,000 in 1,000,000 shares of £1 each, with power to increase from time to time. The issued capital at date is 600,000 ordinary shares of £1 each, fully paid, which are held by the undermentioned companies in the following proportions: Amalgamated Zinc (De Bavay's), 240,000 shares; Broken Hill South, 120,000; North Broken Hill, 120,000; Zinc Corporation, 120,000; total 600,000.

It is intended to increase forthwith the subscribed capital by a further issue of ordinary shares, which will be offered to the shareholding companies pro rata to the respective holdings at this date. Steps will then be taken to increase the authorized capital to £2,500,000, divided as follows: 1,250,000 ordinary shares of £1, 1,250,000 8 per cent cumulative participating preferential as to capital and dividends, and ranking *paripassu* with the ordinary shares in any dividend distribution over and above 8 per cent on such ordinary shares; and to issue as rights to the individual shareholders in the constituent companies 1,050,000 of such preference shares. Of the 1,250,000 ordinary capital, 350,000 shares of £1 each fully paid will be issued to the Mount Read & Roseberry Mines Ltd. in terms of the agreement. These shares will be deferred as to dividends until July 31, 1925, after which date they will rank with the other ordinary shares issued in any distribution of profits.

The assets acquired under the agreement comprise the Hercules and Roseberry groups of mines, with ore reserves estimated at over 1,000,000 tons of the following average: 27.40 per cent zinc, 7.30 per cent lead, 9.57 oz. silver per ton, 0.127 oz. gold per ton. In addition the interest is acquired in an option to purchase the Zeehan smelters from the Government of Tasmania.

In a circular to shareholders, the directors of the Mount Read & Roseberry Mines point out that the issued capital of that company is 256,503 shares, and the company is under obligation to issue 97,500 shares to the Tasmanian Copper Co., making a total of 354,003 shares. The company is indebted to the Mount Lyell company for advances made for working capital to a total of £180,000. An arrangement has been made for the discharge of this indebtedness by an allotment of 180,000 of the deferred ordinary shares in the Electrolytic Zinc Co. In consideration of the Mount Lyell company being released from any further obligation under its agreement with the Mount Read & Roseberry Mines it will accept an allotment of 30,000 deferred ordinary shares in the Electrolytic Zinc Co. in full settlement of its rights as the holder of 100,000 shares in the Mount Read & Roseberry Mines. On a proportional basis, the Mount Lyell company would have been entitled to approximately 48,000 shares. Should it be decided to distribute the remaining 140,000 deferred ordinary shares in the Electrolytic Zinc Co., shareholders would receive approximately fifty-five such shares for each 100 shares held by them, but the distribution will be slightly reduced by the number of shares required to meet the company's expenses after June 30, 1920. The Mount Lyell company will have the right to apply for 90,000 out of the 150,000 participating cumulative preference shares in the Electrolytic Zinc company, which the Mount Read & Roseberry company is entitled to subscribe for at par. It is the intention of the board to give shareholders the opportunity of taking up the remaining 60,000 shares when the issue is made by the Electrolytic Zinc Co.



MINE RESCUE CAR NO. 1 OF U. S. BUREAU OF MINES

The Lake Rolleston scheme, like the King River scheme, will be held in abeyance for the time being. It will be possible to concentrate upon the Great Lake scheme. All mining, smelting and concentrating will be done at Roseberry and Zeehan. At the same time power will be carried to Launceston.

Gold Canyon Dredging Co.'s Start A Gala Occasion

Large Crowd Sees New Dredge Begin Work—Governor Emmet D. Boyle Addresses Gathering

The intense interest which has been manifested in the operations of the Gold Canyon Dredging Co., at its immense holdings of gold placer ground but a few miles from the historic Comstock lode in Nevada, culminated on Sunday, Sept. 5, when not less than 1,200 people came to see the big steel dredge begin its work. Men prominent in the mining world were present, many Californians being among them, though Bulkeley Wells, president of the company, and Harry Payne Whitney, one of the principal stockholders, were unable to come.

The interest in the occasion felt by most of the visitors was expressed by George L. Hurst, manager of the dredging department of the Bethlehem Shipbuilding Corporation, of San Francisco, who said: "This is a great gala occasion. I have never seen anything like it. You would think we were launching one of Uncle Sam's battleships. This is even better, for not one of our sixteen launchings in 1918 drew such a crowd as this."

Among those who addressed the crowd before the current was turned on and the dredge put in operation were: Roy H. Elliott, assistant manager of the Gold Canyon Dredging Co., who acted as master of ceremonies in the absence of President Bulkeley Wells and General Manager Fred G. Farish; Walter E. Clark, president of the University of Nevada; Dr. Aurelia Rhinehart, president of Mills College, California; Emmet D. Boyle, Governor of Nevada; and Edwin Higgins, consulting engineer for the company. The latter gave many interesting facts regarding the history of gold dredging in general, as well as the particular dredge on which he was standing.

Program Committee Named for Mining Congress

The advisory program committee for the convention of the American Mining Congress to be held at Denver, Col., in November has been appointed with the following membership: Bulkeley Wells, ex-officio chairman; D. W. Brunton, Albert Burch, James F. Callbreath, John C. Howard, E. W. Parker, Col. Warren W. Roberts, Carl Scholz, George Otis Smith, J. E. Spurr, and Francis A. Thompson.

Civil Service Examinations

Those interested in the following should apply to the Civil Service Commission, Washington, D. C., for form 1,312, stating the title of examination desired:

Ore-dressing engineer, $2,400-$3,600; both sexes; male eligibles preferred. An open competitive examination. Applications received up to Oct. 12. A vacancy in the Bureau of Mines, for duty at Moscow, Ida., may be filled from results of examination.

Recent Production Reports

Shattuck-Arizona in August produced 194,003 lb. copper, 563,452 lb. lead, 34,661 oz. silver and 406.71 oz. gold. Production of copper in July was 166,938 lb.

Sons of Gwalia, Kalgoorlie, crushed 11,120 tons of ore in July yielding £15,919 in gold, this value being based on the normal price of gold.

Cerro de Pasco produced 4,444,000 lb. copper in August, compared with 3,652,000 in July.

Phelps Dodge produced 8,365,000 lb. copper in August compared with 8,357,000 in July. Of the August output the Copper Queen Branch produced 5,054,000 lb.; Moctezuma Copper, 2,490,000; Burro Mountain Branch, 92,000; and custom ores yielded 729,000.

North Butte produced 1,286,137 lb. copper in August.

U. V. Extension's August production was 5,805,568 lb. copper against 3,304,878 in July.

Calumet & Arizona produced 5,200,000 lb. copper in August, of which 3,650,000 lb. was available for the company. The figure corresponding to the latter in July was 3,528,000.

New Cornelia's August output was 3,842,000 lb. copper, as compared with 3,522,000 in July.

Miami Copper produced 4,630,720 lb. copper in August against 4,459,298 in July.

Arizona Copper's output of copper in August was 3,000,000 lb., unchanged from recent months.

Inspiration produced 7,200,000 lb. copper in August against 6,500,000 in July.

East Butte's smelter produced 1,566,800 lb. copper in August against 1,537,880 in July.

Utah Copper's August production was 8,820,000 lb. copper against 8,500,000 in July.

Chino Copper produced 4,000,148 lb. copper in August compared with 4,360,932 in July.

Ray Consolidated's output in August was 4,505,000 lb. copper compared with 4,500,000 in July.

Nevada Consolidated's August production was 4,650,000 lb. copper, unchanged from June and July.

Greene-Cananea's August output was 3,500,000 lb. copper unchanged from July.

Butte & Superior's August output was 7,800,000 lb. zinc and 140,000 oz. silver against 7,914,024 lb. zinc and 159,778 oz. silver in July.

Interstate Callahan produced in August 4,452,000 lb. of zinc concentrates carrying 52-53 per cent zinc, 2,014,000 lb. of lead concentrates (including some lead ore) running 60 per cent lead, and 20,140 oz. silver. Zinc concentrates produced in July totaled 4,400,000 lb., the grade being the same as that given above.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Bureau of Mines To Study Drill Steel

More work will be done by the U. S. Bureau of Mines in the near future on problems looking to the improvement of drill steel. Some work has been done on this subject by the Bureau, but in view of the revelations at the recent meeting of the American Institute of Mining Engineers more attention will be given the matter. It was pointed out very clearly at the meeting that, while there has been great development in drills during the past two decades, there has been little if any improvement in drill steel. If a steel is developed which will stand up longer, it will mean the saving of considerable losses of time in changing drills.

Officials of the U. S. Bureau of Mines have been surprised by the number of companies that are directly interested in the lead and zinc industry in the Mississippi Valley. A list of such companies was compiled so that invitations could be issued to their representatives to attend the meeting in St. Louis on Oct. 9. On Sept. 11, there were 137 companies on the list, with prospects that others would be added.

Before the nature of the mining and the metallurgical work, which is to be undertaken at the new experiment station at Rolla, Mo., is determined the Bureau wants to hear from the industry itself as to what problems are most pressing. The appropriation for the work is $25,000, which is too small to permit the study of all of the problems.

With the development of sources of aluminum in certain clay deposits, there has come an insistent demand that the Government undertake some work on that subject. Some are of the opinion that aluminum-bearing clays which could be worked profitably are much more widely distributed than is generally supposed. This carries with it the possibility of using these clays as a source of aluminum oxide.

It is also claimed that the small operators, who are trying to get a foothold in the aluminum industry, are entitled to the results of Government research in such matters as cheap methods of manufacturing aluminum oxide and the losses in re-melting. The highly organized concerns in the industry are able to carry on their own research but it is argued that it would be in the public interest for the government to undertake work on such problems as would be of benefit to the entire industry, especially to the smaller interests.

In addition, it is requested that research be done on the alloys of aluminum. It was pointed out that the Germans developed duralumin for their Zeppelin construction, an alloy at once light and of great strength. It is believed that aluminum alloys alone offer a great field for development.

It is also pointed out that there is great need for research in the whole matter of non-ferrous alloys. The demand for alloys with special properties has been augmented greatly by the development of automobile and aeroplane industries. Even in an alloy as well understood as is brass, the full possibilities of varying the percentages of copper and zinc have not been realized.

War Minerals Awards

Awards recommended by the War Minerals Relief Commission, for the week ended Sept. 4, are as follows (the name of the claimant, the mineral, the amount recommended and its percentage relationship to the amount claimed are shown): G. L. Sledge, manganese, $100, 23 per cent; Bulkeley Wells, chrome, $7,098.95, 45 per cent; Ozark Manganese Co., manganese, $4,290.76, 39 per cent; the Hillside mine, chrome, $10,642.27, 63 per cent; Floyd Brown, manganese, $132, 4 per cent; E. K. Hoy, chrome, $845.50, 14 per cent.

In the pyrites claim of the Kelsey Mines Co., the Commission previously awarded $1,961.21. A further allowance of $918.84 has been made. In the chrome claim of Byrnes Bros., which was disallowed, the sum of $400.96 has been awarded on a re-examination of the claim. On a previous award, J. J. Cummings, Jr., was allowed $120 on a manganese claim. An additional $487.50 has been allowed. To date the Commission has acted on 994 claims.

Building materials have soared to such a point that the Government bureaus interested are studying every possible economy. It is believed that great economies can be effected in the mining of the non-minerals which are used so extensively in the building trades. During 1920, it is estimated that $400,000,000 worth of non-minerals and mineral products were used for those purposes. It is claimed that the average efficiency is low in the recovery of talc, soapstone, slate, limestone, granite, building stone and gypsum.

NEWS BY MINING DISTRICTS

SOUTH AFRICA

American Vanadium & Lead Mines, Ltd., Organized

Johannesburg—An important flotation has recently been announced under the name of the African Vanadium & Lead Mines, Ltd. The nominal capital is £200,000, of which £105,000 is to be issued. The chief object of the company is to take over and continue the working of the Doornhoek vanadium and lead mines in the Zeerust district. It is intended to supplement and improve the existing plant by the installation of a new haulage system, a concentrator, water supply, and power and lighting equipment for the production of high-grade lead and vanadium concentrates for shipment overseas or for local realization, and to acquire the existing stocks of ore.

The operations at the mine have hitherto been confined to recovery of galena nodules containing 80 per cent of lead and 6 oz. of silver per ton, which occur with great frequency. In the course of recovering these nodules, large quantities of lead ore, finely disseminated in the gangue, were recovered, and in the absence of any means of concentration were dumped on the surface. The masses thus dumped and available for immediate shipment are stated in the company's prospectus to be approximately 100,000 tons. Samples of these dumps show value varying from 5.83 per cent to 23.35 per cent lead after removing all visible galena.

It is also planned by the company to erect a plant for smelting and reducing vanadium and lead ores and concentrates, if this be found necessary. The remaining area may also be explored and prospected.

CANADA

Ontario

Government Not To Build Branch of T. & N. O. Ry. to Kirkland Lake—Dome Shareholders Ratify Dome Ex. Proposal

Porcupine—At a special meeting of the shareholders of the Dome Mines on Sept. 4 the proposal of the directors to purchase the property of the Dome Extension Co. was unanimously ratified. The shareholders of the Dome Extension will receive one share of Dome stock for each thirty shares of their Dome Extension holdings.

The new hospital of the Hollinger Consolidated, constructed on the most modern design, is almost completed. The main building is 113 x 37 ft. with a westerly wing 37 x 39 ft. The normal capacity is 35 patients, but in case of emergency twice that number could be accommodated.

At the North Davidson an orebody, reported to be 4 ft. wide, has been encountered in the shaft at a depth of 60 ft.

Boston Creek—The Miller Independence has cut several promising stringers conveying iron and copper sulphides on the 500-ft. level. The inclined shaft which opened up rich ore at a depth of 200 ft. has been dewatered for the purpose of further exploration.

The Patricia mine, which has been closed down since the plant was destroyed by a bush fire last fall, has been optioned to T. J. Flynn.

Kirkland Lake—The mine managers of Kirkland Lake have been officially advised by the Ontario government that they do not intend to construct a branch line of the Timiskaming & Northern Ontario Ry. to the camp at present. This change of plan is due to the attitude of the Associated Goldfields of Larder Lake in refusing to submit its property to inspection by government engineers. In the first instance the government declared its intention to build the railway to Kirkland Lake, a distance of four or five miles. The mining interests stated that a good macadam road would be preferable, and the government acceded to their request and constructed a motor road at a cost of $100,000. Then the railway proposition was renewed in connection with the opening up of new mining territory lying between the proved up Kirkland Lake area and Larder Lake, and was favorably considered, the government promising to build the road, provided the property owners interested would permit government engineers to report on their resources and that their finding warranted the construction of a railway. Now the government announces that inasmuch as the Associated Goldfields, the only operating company at Larder Lake, has not accepted the provision for an examination of its property, and that as it has complied with the wishes of the Kirkland Lake operators in regard to the motor road, it would not feel justified in proceeding with the construction of a railway at the present time.

The Ontario government has begun the building of a wagon road from the Tough-Oakes mine east through Level township to Mud Lake.

At the Hunton Kirkland sinking operations have been begun, to carry the shaft down from its present depth of 40 ft. to the 200-ft. level.

Cobalt—New equipment, including a

shoveling machine and crushing machinery, is being installed at the Kerr Lake to handle a large tonnage of low-grade ore on the dumps, which will be shipped by aerial tram for treatment at the Dominion Reduction plant. Production is being maintained at upward of 50,000 oz. of silver per month.

ARIZONA

Ash Peak Extension Under Development

Duncan—The Ash Peak Extension is being developed and operated under the management of John Horrigan. The shaft has been sunk to the 500-ft. level, and drifting is in progress on the vein, which is 9 ft. wide and assays 25 to 30 oz. silver per ton. Eighteen to twenty tons per day is produced from development work, and transported by motor truck a distance of 10 miles to Duncan, whence it is shipped to the smelter at El Paso. This development is on the northwesterly extension of the Ash Peak vein, which outcrops prominently for a continuous distance of about two miles.

The Ash Peak Mining Co. has developed its property by the 800-ft. Shamrock shaft and the 500-ft. Commerce shaft, together with about 7,500 ft. of drifting on the vein. Much of this development work is in payable ore averaging about 14 oz. silver and $1 gold per ton. The company plans extensive surface improvements in the near future. The new equipment will include a 100-ton cyanide mill, compressor plant and new hoisting machinery at the Shamrock shaft. Arthur Murphy, Jr., is manager.

CALIFORNIA

Rich Strike Made at Spanish Dry Diggings—La Grange Hydraulic Mine Stripped of Equipment

Placerville—A rich vein of ore has been cut in the old Grit Consolidated mine at Spanish Dry Diggings. The strike was made by going below the old tunnel with the development work. The mine was formerly owned by William Buckman, who sold out his interests to the Grit Con. Mining Co. for $30,000. The property was one of the richest mines in the early days, but the vein was lost and has been sought continually until it was recently relocated by the present owners.

Grass Valley—The power shortage has seriously affected the employment conditions in this country and the latest result of the curtailment of power is that the Idaho-Maryland has let out thirty-five of its men until power conditions improve. Although the period of unemployment is known to be only temporary, many of the miners are leaving for other places, and the prospects are that when power is again normal there will be a dearth of miners.

The recent strike at the Alcalde mine is said to be fully as good as at first reported. Much ore has been taken out, and a large body of very rich ore uncovered.

Redding—The Yankee John Development Co., operating four miles west of Redding, has purchased the Simmons ranch, including the Reese reservoir and water rights. The deal was made principally because of the water rights, which will enable the new owners to obtain ample water supply for operations at the Yankee John gold mine.

The last lot of machinery has been removed from the famous La Grange hydraulic mine near Weaverville, and will be shipped to China. The noted old producer, for many years the largest hydraulic property in the world, was closed a few years ago, and at present indications are that it will never again be worked.

Sutter Creek—The Central Eureka Mines Co. has cut its main orebody on the 3,900-ft. level. Because of the shortage of electric power the output for last month was greatly curtailed, and only twenty stamps could operate. Instead of the usual three shifts, only two were able to work.

The Argonaut has been unwatered to the 3,300-ft. level, and plans are being made for renewing development at this point, for it was here that the rich orebody was first encountered and was afterwards traced and mined to the 4,800-ft. level. Unwatering is continuing at the rate of about 150,000 gal. daily.

Bakersfield—The Rand Silver mine reports that it has $3,000,000 worth of ore in sight and is paying dividends amounting to $25,000 per month.

NEVADA

Nevada Con. Opens Large Orebody at 700 Level—Gold Pen Mines Co. Shuts Down

Ely—A large body of high-grade ore is said to have been opened up by Nevada Consolidated on the 700-ft. level of the Ruth mine which is said to be getting richer as development proceeds. When this orebody was examined several weeks ago by Louis Ross, it was figured that it would run "better than 7 per cent copper," but late reports indicate that the values are much in excess of the figure given. It has been drifted on for a distance of 100 ft. and crosscutting is in progress to see if the width is as great as on the levels above. Great significance lies in the fact that this same orebody averages but 2½ per cent copper on the 500 and 600 levels above. A saving of 20c. per ton in treatment costs is expected as a result of rearranging the company's mill at McGill so as to use flotation, also an increase in extraction by five per cent. At full capacity the mill treats 14,000 tons daily.

Rand—The property of the Gold Pen Mines Co. at the camp of Rand, near Rawhide, has been shut down. A disagreement of the principal stockholders as to future operations is said to have been the cause.

Pioche—The Burke mine, one of the principal producers in the Pioche district in the early 70's, is being opened under lease from the Amalgamated Pioche Mines & Smelters Corp. to Charles Stindt and associates of Pioche. Preliminary examination disclosed the impracticability of utilizing the old two-compartment Burke shaft, through which the mine has been developed in the past, and it was decided to sink a new incline shaft at a point about 1,000 ft. easterly on the Burke fissure. This incline is now down 75 ft. and is following the well-defined Burke fissure, which has a dip of 50 deg.

Ore shipments from the Pioche district for the week ended Sept. 3 were as follows: Prince Consolidated, 1,900 tons; Virginia-Louise, 800 tons; Black Metals, 100 tons; Bristol Mines, 250 tons; Combined Metals, 150 tons; Con. Nevada Utah, 40 tons; total, 3,240 tons.

IDAHO

Coeur d'Alene District

Amazon Dixie To Resume Development Soon; Will Deepen Shaft—Big Creek Co.'s Flume Completed

Wallace—The installation of new electrical equipment by the Amazon-Dixie Mining Co. is nearing completion and development will be resumed at once. An electric transmission line has been completed to the mine and a large transformer is being placed at the point of diversion from the main line of the Montana Power Co. A large station on the main tunnel level has been cut to accommodate a new electric hoist, a new compressor is in position, new dry room completed, and various other additions are in preparation for operations on a larger scale. Considerable ore is exposed in the main tunnel for a distance of 600 ft. From this level a shaft has been sunk 400 ft., from which the vein has been explored 350 ft., showing more and better ore than in the tunnel. The plan now is to sink 400 ft. further with the expectation of developing sufficient ore to justify the construction of a mill. The ore is lead-silver. Wesley Everett is manager of the company. The control is owned by Cleveland men of large means.

An important strike of copper-silver ore is reported by the Lookout Mountain Mining Co., operating on Pine Creek. Driving on the vein has exposed two and a half feet of ore which carries high values in both metals, and work on the surface indicates that it is the beginning of a long ore shoot. The company is also driving a tunnel to a very promising lead-silver vein. Control of the company is owned in Kellogg.

The Big Creek Mining Co. will resume operations at once. The company was restrained from permitting the mill water and tailings from entering the creek on complaint of the Kellogg Power & Water Co., which alleged contamination of the water, which is used for domestic purposes in Kellogg. The company has now completed a flume

which will convey the water from the mill to a point far removed from the creek. The management states that the mine and mill are now in position to insure steady operation.

The Montana-Standard, a silver-lead property that has been idle for many years, situated in Montana near the Idaho line, twelve miles from Thompson Falls, has been taken under bond and lease by Mahoney Brothers, of Spokane (until recently of Wallace). It is announced that development and probably shipments will begin at once.

L. W. Stedman, manager of the Paragon Mining Co., which holds a large group of claims about five miles above Murray, states that he expects to begin shipping soon. The company has a 100-ton mill which has been completely overhauled and repaired. The product of the company is both lead-silver and zinc. The ore will be moved to the railroad at Prichard or Delta by motor trucks. F. O. Hammer, of St. Paul, secretary of the company, recently spent several days at the mine.

UTAH

Eagle & Blue Bell's Operations Normal —Tintic Standard Building Mill Foundations

Eureka—Ore shipments from the Tintic district for the week ended Sept. 3 amounted to 141 cars. The Eagle & Blue Bell is keeping up its regular output of about 100 tons daily, the ore coming from levels between the 1,000 and 1,800 levels. The disaffection of a few radicals was unable to impair the working force and the company has the usual number of men at work. Development work, suspended for a time, has been resumed.

The Pinion Queen is working three shifts and sinking its shaft as rapidly as possible. E. J. Raddatz of the Tintic Standard is president.

The Mammoth is disposing of its 250,000 tons of dump ore, said to be worth about $7 a ton, at the rate of two cars a day. The mine is also sending out first class ore from its workings.

The Tintic Standard has a large force at work on the foundations of the mill which it is building at Warm Springs Creek. The boarding house, pump house, machine shop and other buildings have already been constructed.

In the Plutus, small stringers of ore have been opened on the 1,700 level, and prospects of ore in commercial amount soon are considered good.

Bingham Canyon — The Montana-Bingham is now under the same direction as the Bingham Mines. Imer Pett is manager.

Salt Lake City—The Woodlawn property in Big Cottonwood is being developed and a shipment is expected soon. Ore is reported in three places.

Park City—Shipments of ore and concentrates for the week ended Sept. 3 amounted to 2,186 tons, the Ontario and the Silver King Coalition with 600 and 582 tons, respectively, heading the list.

MONTANA

Davis-Daly Makes Rich Strike on 2,700 Level

Butte—On Sept. 11 the Davis-Daly company opened 27 ft. of ore running 6½ per cent copper and 5 oz. silver on the 2,700 level of the Colorado mine. The strike was made in drifting on an orebody already opened. It is said that this development is one of the most important of the year in the Butte district.

SOUTH DAKOTA

National Tin Corporation Suspends Operations—Cutting Mine Closed Down

Hill City—The operations of the National Tin Corporation have been suspended. It is not stated when work will again be resumed. Alexander Roy, manager, has gone to New York City to attend a meeting of company officials, after which a statement will probably be made as to what will be done in the future.

Deadwood—The Cutting mine has closed down. The large amount of water encountered within the last few months has made this advisable. It is not stated as to just when operations will be resumed but it is certain that no work will be done until suitable pumps can be installed.

Lead — The electrification of the Homestake company's Ellison hoist is being pushed. Some of the machinery has arrived and is being placed in position. When completed this shaft will be equipped with skips and together with the B. & M. hoist will raise all the ore from the mine.

JOPLIN-MIAMI DISTRICT

Oklahoma-Kansas-Missouri

Federal Company Takes Option on Acme Mill and Lease—Much Activity Near Baxter; 20 Prospect Drills Running

Commerce, Okla. — Otis W. White started up two mines in the Oklahoma field on Aug. 11 that have been idle for several months. One was the Otis L., formerly known as the Sullivan, at Commerce, and the other the Miami Metals, at Picher, which has been down since a tornado destroyed its hopper and derrick last spring. Part of the dirt at the Otis L. will be taken from the old Queen City lease, hoisted from a shaft on the Emma Gordon lease and milled at the Otis L. mill on the Sullivan lease. The office for both mines will be at Commerce. White is manager for both properties, with Edward Depee holding the contract for hoisting the dirt at the Otis L. and L. E. Cartwright superintendent for the Miami Metals.

Joplin, Mo.—Creech & Baker have taken a lease on the Fifteenth Street mine in Joplin. They have pumped the water out and are making a good production from four drifts in ore.

Picher, Okla.—The St. Louis S. & R. Co. has completed a new shaft a quarter mile southeast of the mill shaft at its No. 1 mill and has started operation of that property once more after idleness of several months. The dirt is being carried to the mill over a surface railroad. The company has been operating its No. 2 mill steadily. Its mill on the Kropp land, about a mile to the southeast, gave a recovery of 11 per cent (in local parlance) for August. Charles E. Schwarz is manager for the St. Louis.

Hockerville, Okla.—The Federal M. & S. Co. has taken a thirty-day option on the Acme Mining Co.'s mill and lease southeast of Picher and is drilling the ground. The option is on the lease and the No. 1 mill, the No. 2 mill being reserved by the Acme company for treating tailings. The Federal's Lucky O. K. company is having success with the Farmington property, located across the Oklahoma-Kansas state line to the south, and seems to have a good mine there although it had been virtually condemned by other operators. P. W. George is district manager for the company.

Baxter, Kan.—Continued production is being made by Chanute Spelter Co., a subsidiary of American Metal Co. At its Hartley mine west of Baxter it produced 1,905 tons of zinc and lead concentrates in August. The recovery for the month averaged 19 per cent (locally speaking). The company is sinking a shaft on its Brewster land lease one mile north of the Hartley and has it down to 175 ft. It expects to encounter water at 195 ft. and will go to 230 ft. for ore. The company is not expecting any such head of water as at Hartley, where company officials say one million dollars was spent before a pound of ore was produced, most of it being for pumping. About 2,500 gal. per min. still being pumped at this property.

General activity continues in the vicinity of Baxter on account of the rich ground found in the Chanute Hartley mine, and twenty prospect drills were working on Saturday, Sept. 11, on leases in this territory. Two shafts were also going down, one by the Victor Rakowsky interests on a lease just north of the Hartley and another by Messe and associates, one mile west of the Hartley.

LOUISIANA

Myles and Avery Island Companies Shipping Salt Steadily — Jefferson Island's Deposit Being Developed

Weeks Island—The Myles Salt Co., operating at Weeks Island, Iberia Parish, is making regular shipments of sized salt and of compressed salt bricks. Shipments are reported to be anywhere from 500 to 1,000 tons daily. The mine and breaker are completely electrified, and electric haulage and electric shoveling machines are used underground.

Avery Island—The Avery Island Salt

Mining Co., at Avery Island, Iberia Parish, is shipping a large tonnage of salt daily, some of it in the form of high-grade rock salt. Considerable new work is planned at this property including the sinking of an air shaft and the complete electrification of the plant.

Jefferson Island — The Jefferson Island Salt Co. started work about eight months ago to develop the salt body on Jefferson Island. This is on the line between Iberia and Vermilion parishes and about three miles north of the Abbeville branch of the Southern Pacific R.R. To date only development work has been done. Considerable difficulty is being experienced in making a watertight seal between the overlying strata and the salt. A three-mile railroad spur is under construction from the main line to the mine.

ALABAMA

Secondary vs. Primary Iron Ore Tonnage Discussed

Birmingham—The estimated tonnage of secondary ores in the South has materially increased in the last few years against a decrease in that of the primary ores. The possible exhaustion of the ores of the northern ranges is being discussed while to the fore comes the fact that development in the secondary ores is showing greater possibilities than have ever been considered and attention is bound to be attracted to the South, to the Alabama fields and to adjacent states. Investigations have been made recently as to secondary ores and interesting conclusions have been arrived at. Y. A. Dyer, mining and consulting engineer of Birmingham, who has just returned from a trip through the iron ore lands of Alabama, Georgia and other Southern districts, was asked for an opinion on the subject by the correspondent of the *Engineering and Mining Journal*. He made the following statement:

"With pig iron production in the United States proceeding at the rate of 32,000,000 to 35,000,000 tons per annum, requiring an average ore consumption of 65,000,000 to 75,000,000 tons, there is little wonder that the iron and steel interests of this country are ever on the alert for prospects which may lead to augmenting their ore supply—more particularly the reserve supply of what is commonly termed merchantable or primary ore.

"There is no discounting the fact that the United States has from 75,000,000,000 to 80,000,000,000 tons of non-merchantable or secondary ores, but the 'eternal trend' in the past and at present has been and is to woefully disregard secondary ores and vigilantly seek to mine, at maximum production, the primary ores. Thus far the universal policy has been to sidestep even the blending of primary and secondary ores in furnace mixtures, except in extreme cases of necessity. According to the Eckel estimate (which I consider a thorough and practical one) of 1912, the United States is conservatively and rationally credited with possessing 7,550,000,000 tons of "available" or primary ores. Since that period, to the present date, there has been mined approximately 531,000,000 tons with approximately 400,000,000 tons credited to Lake ore operations. This would leave 7,019,000,000 tons of primary ores now credited to the United States.

"At the time the Eckel estimate was made, the Lake district was credited with maximum reserves of 2,500,000,000 tons and Southern red ores 2,000,000,000 tons. Since that time approximately 400,000,000 tons of Lake ores have been exhausted and approximately 50,000,000 tons of Southern red ores, bringing the Lake reserves to 2,100,000,000 tons and Southern red ores to 1,950,000,000 tons. However, since 1912 there have been no new developments which have raised the Lake ore estimates, while in the Birmingham district the Shades Valley deposit of self-fluxing ore has been proven up by drill-holes, shaft and slope at depths ranging from 1,100 ft. to 2,000 ft. This proven area of basin ore practically doubles the tonnage estimate of self-fluxing red ore and very materially increases the secondary ore tonnage estimate outside of the self-fluxing area. One company alone, which has put a twin slope into operation, estimates its tonnage of self-fluxing ore in Shades Valley to be 10,000,000 to 15,000,000 tons. The district's ore production rate of 6,000,000 to 7,000,000 tons annually seems to cause no immediate concern, even among large producers, with reference to the exhaustion time of primary ores. Two hundred to 300 years' supply of primary ores, at present mining rate, seems a long time in the future, compared with thirty to thirty-five years' supply, at the present rate of exhaustion, of primary Lake ores. To the trained engineed this is a powerfully appealing factor, for it means that furnace practice from the standpoint of raw materials in the Birmingham district is fixed for many years hence and practically the only mining methods which are likely to change are slope to shaft and haulage conditions. The character of deposit, analysis of ore and thickness of vein have been proven persistent. In fact thickness of vein has increased with depth from the outcrop to basin.

"Except in the case of foundry iron producers, the large deposits of rich brown ores seem to have been temporarily forgotten. The above tonnage estimate of red ores does not take into consideration the 75,000,000 tons of 'available' brown ores credited to Alabama by Eckel. At present these deposits are only worked sporadically for the reason that attention seems to be riveted, for the time at least, on low-cost self-fluxing ore. There has been no decrease in the quality of brown hematite ores. In fact, thus far only the rich wash deposits have been worked to any extent in the Warrior drainage area, Tennessee drainage area and the Appalachian deposits extending from the Shelby deposits on the south to the Rock Run-Piedmont area on the east. The term 'non-merchantable or secondary brown ore' is only applicable in the sense of 'availability' either from the standpoint of mining cost or transportation conditions. In time either will be met by rational mining and washing methods, for the richness of the ore is practically the same whether the washing ratio be 1:20 or 1:2. It simply involves the flushing of much or little earthy matter in which the ore is imbedded. The conglomerate boulder, or mountain ore, is not taken into consideration in tonnage estimates. There are many million tons of this type ore in Alabama. Only the valley or gentle sloping hill ore constitutes the brown ore tonnage of Alabama and the South. What may be termed 'inaccessible,' for the time being, brown ore in the state of Alabama will constitute many million tons, and throughout the distance from Shelby, Ala., on the south to Canton, Ga., on the east the total tonnage will reach well up into the nine-figure column. Prospect work is being done constantly on the brown ores of Alabama and Georgia, and I have covered the ground through the entire area inspecting, prospecting and reporting on various properties within the past four years."

CHRONOLOGY OF MINING

August, 1920

Aug. 2.—Burro Mountain branch of Phelps Dodge Corporation started first unit of new mill.

Aug. 7.—Rochester Combined Mines property in Nevada advertised for sale. —New mine-rescue car of Bureau of Mines destroyed by fire in shops of New York Central R.R.

Aug. 17.—Ontario Mining Association held first general meeting, at Sudbury, Ont.—Change house at Cliffs Shaft mine, Ishpeming, Mich., damaged by fire.

Aug. 20.—Steamer "Superior City" of the U. S. Steel Corporation, sank in Lake Superior in collision with the "Willis L. King" of Jones & Laughlin; 29 lives lost.—Gruss Copper Co., Portola, Cal., started new 15-stamp mill.

Aug. 23.—Lake Superior Meeting of A. I. M. E. formally opened at Houghton, Mich.; closed at Duluth, Minn., on Aug. 28.—Pedro Zamora, Mexican bandit, released Charles Hoyle and five other American and English engineers, retaining for ransom W. A. Gardiner and W. B. Johnson.

Aug. 24.—Case of Northport Mining & Smelting Co. vs. Lone Pine-Surprise Consolidated Mining Co., opened at Spokane, Wash., before Judge Rudkin. —Public Utilities Commission of Utah refused to allow increase in freight charges on shipments of coal and ore. —Manganese ore shipment from Brazil reached Mobile, Ala., for consumers in Birmingham district.

Aug. 26.—Freight rates on lead bullion and blister copper from Salt Lake smelters to Atlantic seaboard raised ½ per cent.

THE MARKET REPORT

Daily Prices of Metals in New York

Sept.	Copper	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
9	18.10@18.50	41.75	44.75@45.25	8.75	8.40@8.80	7.70@7.75
10	18.10@18.50	41.75	44.75@45.00	8.65	8.30@8.70	7.65@7.70
11	18.10@18.50	41.75	45.00@45.25	8.50	8.20@8.60	7.65
13	18.10@18.50	41.75	44.75@45.00	8.50	8.30	7.65
14	18.10@18.50	42.00	44.75@45.00	8.45	8.25	7.65
15	18.10@18.50	42.00	44 75@45.00	8.40	8.20	7.65

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point. All prices are in cents per pound.

Copper is commonly sold on terms "delivered," which means that the seller pays the freight from refinery to buyer's destination. The delivery cost varies, and it would be confusing to figure net prices on individual transactions. Consequently, an average deduction of 0.15c. is made from the "delivered" price, to arrive at the New York price. When copper is sold f.o.b. or f.a.s. New York, of course no deduction is made.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	M
9	97¼	97½	112	267	273¾	35¾	35½	39	40¼
10	97	97¼	112	269½	275½	35½	35	39¾	41
11	...	...	...	...	...	...	...	...	...
13	97¾	98	112	272¾	279	35¼	34¾	39¼	40½
14	99¾	99¾	112	274½	279½	35	34⅝	39⅛	40⅝
15	100	99½	112	273¾	279¾	34¾	34½	39⅛	40⅜

The above table gives the closing quotations on the London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange	Silver			Sept.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
9	352¾	99½	93½	58½	13	348	99½	94	59⅜
10	351	99½	94¼	59	14	344	99½	94½	60¼
11	349½	99½	93½	59	15	345	99½	95	60¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

On the authority of the Secretary of the Treasury, we quote 100c. per oz. for silver, 1,000 fine, delivered at the option of the Director of the Mint to the New York Assay Office or to the mints in Philadelphia, Denver, or San Francisco, and proved to the satisfaction of the Treasury Department to have been mined, smelted, and refined in the United States. This quotation is retroactive to May 13.

Metal Markets

New York, Sept. 15, 1920

There has been no substantial improvement in the metal market. Buying of the major metals took place in slightly larger quantities this week, but not in such an amount as to disturb the generally dull condition prevailing. This stagnant business in the metal market has now continued for many weeks, particularly in the copper market, but it is the consensus of opinion of those in close touch with the metal trade that improvement will soon set in to raise the position of metals such as copper and zinc. The London market showed a slightly upward trend on Monday, Tuesday and Wednesday of this week.

Copper

The purchases of copper improved slightly during the week, and consumers in general are still refraining from purchasing large quantities. It is naturally to their advantage to be able to obtain copper at the low market prices, and they realize that they can purchase sufficient copper for their current needs at attractive quotations. However, producers are satisfied that a better sentiment is developing among copper consumers and that it will take but a small impetus to raise the market out of the depths and place it on a higher level. Little interest is manifested in futures.

Lead

On Monday, the A. S. & R. Co., reflecting the downward tendency in the market, lowered their official price of 9c. New York, to 8½c. Our quotation, based upon sales, still reflects the larger tonnages disposed of by the A. S. & R. at their official price, as stated last week, but the metal could be obtained for prices around 7¾@8c. Lead inquiries are slacking, and the importations of lead which have been made during the last few weeks have partly succeeded in neutralizing the shortage of lead in this country. Consumers are holding off in the anticipation of a further decline, and those importers who expected the market to stay at the recent high level have already had to take unlooked for losses by the recent decline. Consumption of lead is still good. Future delivery is nominal.

Zinc

Prices again showed a slight drop and the market is still quiet. Importations of cheap re-shipment American zinc are being made. All such zinc which can be satisfactorily proven to the authorities to be of American origin is entitled to be admitted duty free, but it is doubtful if in every case the necessary evidence is procurable. Smelters working on bonded and domestic ores are in a position similar to the silver smelters, who are compelled to satisfy the Government as to the origin of all silver proffered at $1 per oz. to the Treasury Department.

Tin

There was a small improvement in the London market during the first three days of this week, but the market is still erratic and quiet. Last Spring, when tin first exhibited a declining tendency, many consumers, not anticipating a further decline, filled their future requirements, to their own detriment, as tin subsequently dropped much further in price. Hence the reluctance of consumers to enter into the market at present. They prefer to wait and watch the market and exchange. Tin consumption is still good, but the production of electrolytic is decreasing.

Straits tin for future delivery: Sept. 9th, 44.75@45.00c.; 10th, 45.00@45.50c.; 11th, 45.50@46.00c.; 13th, 45.00@45.50c.; 14th, 45.00@45.50c.; 15th, 45.25@45.50c.

Arrivals of tin in long tons: Sept, 1st, Penang, 375; 7th, Australia, 100; 9th, Batavia, 100; London, 25; 10th, Straits, 925; China, 175; London, 75; Penang, 200; 13th, China, 175; Singapore, 375; Penang, 400.

Silver

The silver market for the last week has been steady, with a tendency toward higher prices. Business, however, has been done on a moderate scale only, owing to the reluctance of holders to sell at current figures, and a rather limited buying market from the East. There seems to be good reason to look for more activity in the export trade from the Orient. Shanghai rates close at about 106 and Hongkong at 76. Generally speaking, the feeling is that there is room for improvement in the price of silver.

Mexican Dollars—Sept. 9, 71⅛; 10th, 71⅛; 11th, 71; 13th, 71⅛; 14th, 71⅛; 15th, 72⅛.

Gold

Gold in London on Sept. 9th, 115s. 9d.; 10th, 116s. 6d.; 13th 117s. 3d.; 14th, 119s. 0d.; 15th, 117s. 4d. Transvaal gold is continuing to come to this country, and it is said that this week's receipts will make the total over $40,000,000.

Foreign Exchange

Social and political unrest in Europe and a heavy supply of grain and cotton bills have further depressed foreign exchange. Sterling, $3.45, is the lowest since last March. Yesterday, francs were 6.43c.; lire, 4.24c.; and marks, 1.66c. New York funds in Montreal, per cent premium, 9.

Other Metals

Aluminum—Ingot, 99 per cent and purer, 35.1c.; 98@99 per cent, 34.9c. Virgin metal still obtainable in open market at about 32.5c. for 98@99 grade.

Antimony—Market continues weak. Spot, 7c. per lb.; Cookson's "C" grade, 14@15c. Chinese and Japanese brands, 7c. W. C. C. brand, 9@9½c. [1]Chinese needle antimony, lump, firm at 8@9c. per lb. Standard powdered needle antimony (200 mesh), 10@12c. per lb.

Bismuth—$2.70 per lb., 500-lb. lots, and $2.72 per lb., 100-lb. lots. Market quiet.

Cadmium—Nominal, $1.40@$1.50 per lb. Market steady.

Cobalt—Metal, $3 per lb.; black oxide, $2 per lb.

Iridium—Nominal, $350@$400 per oz. Heavy demand, but small supplies.

Magnesium—Crude, 99 per cent or over pure, $1.75 per lb. for the metal in 100 lb. lots and over, f.o.b. Niagara Falls.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $50@$75 per troy oz.

Palladium—$100@$110 per oz.

Platinum—Firm at $115 per oz.; $105 per oz. in 100 oz. lots.

Quicksilver—Market quiet; $75 per 75-lb. flask. San Francisco wires $75. Weak.

Ruthenium—$200@$220 per troy oz.

[1]**Selenium**, black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb. Demand strong.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—$35@$60 per kilogram, according to purity and gage.

Metallic Ores

Bauxite—About 52 per cent alumina content, less than 2 per cent iron oxide, up to 20 per cent silica and artificially dried to contain not more than 4 per cent free moisture, $10 per gross ton at mine; 54 per cent alumina and about 15 per cent silica, $11; averaging 57 per cent alumina, 8 to 12 per cent silica, less than 3 per cent iron oxide, $13 on basis of 8 per cent free moisture. Ores of very low silica content suitable for the manufacture of aluminum oxide and hydrate of alumina command a fancy price.

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a minimum of 6 per cent silica, 70@80c. per unit, New York. California concentrates, 50 per cent Cr_2O_3 and upward, 70@75c. California production has fallen off, even since May, owing to the low price, which does not permit operation of mines that were worked in 1918 when prices were $1.50 a unit for 50 per cent. The market is strengthening, and should prices rise some abandoned properties will be reopened. There are considerable tonnages of 40 per cent ore at different points in California, which are being held for prices of 50@60c. a unit, f.o.b. cars, California.

Iron Ores—Lake Superior ores, per ton, delivered at Lower Lake ports: Old Range bessemer, $7.45; Old Range non-bessemer, $6.70; Mesabi bessemer, $7.20; Mesabi non-bessemer, $6.55.

Manganese Ore—65@75c. per unit, seaport; chemical ore (MnO_2) $70@$90 per gross ton, lump; $80@$100 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 75@80c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**, guaranteed minimum 60 per cent tantalic acid, 55@65c. per lb. in ton lots, against recent price of 65@70c.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 15c. per lb. for ore, with concessions on large lots or running contracts.

Tungsten Ore—Scheelite, 60 per cent WO_3 and over, per unit of WO_3, $7 f.o.b. mines; wolframite, 60 per cent WO_3 and over, per unit of WO_3, $6@$7, in New York.

Uranium Ore (Carnotite)—$2.75@$3 per lb. for 96 per cent of the contained oxide (U_3O_8). Ores must contain a minimum of 2 per cent U_3O_8.

Vanadium Ore—$1.25 per lb. of V_2O_5 (guaranteed minimum of 11 per cent V_2O_5), New York.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

[1]**Zircon**—Washed, iron free, 5c. per lb.

[1]**Zirkite**—$90@$100 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 11—Zinc blende, per ton, high, $49.70; basis 60 per cent zinc, premium, $47; Prime Western, $46; fines and slimes, $45@$42.50. Calamine, basis 40 per cent zinc, $36. Average settling prices: Blende, $47.16; calamine, $38.20; all zinc ores, $46.99.

Lead, high, $108.15; basis 80 per cent lead, $100. Average settling prices, all grades of lead, $103.88 per ton.

Shipments for the week: Blende, 13,102; calamine, 250; lead, 1,565 tons. Value, all ores the week, $790,080.

Platteville, Wis., Sept. 11—Blende, basis 60 per cent zinc, $53 base for one choice lot of 180 tons down to $50.50 contract price for high-grade. Lead ore, basis 80 per cent lead, reduced to $100 per ton. Shipments for the week. Blende, 787; lead, 194 tons. Shipments for the year: Blende, 49.046; calamine, 2,360; lead, 4.115; sulphur ore, 1,241 tons. Shipped during week to separating plants, 1,511 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, $2,400@$3,000; No. 2, $1,400@$1,700; spinning fibres, $400@$800; magnesia and compressed sheet fibres, $325@$400; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as Canadian royalty export sales tax. Freight rate from mines to Sherbrooke, Quebec, over Quebec Central R.R., 20c. per cwt.; from Sherbrooke to New York, 27½c., carload lots; freight to New York for crude No. 1, f.o.b. Thetford mines, $8.45 per ton, carload lots. Car scarcity worse than ever before.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $12 per gross ton; ground (white) $23@$25; ground (off color) $16@$19 per net ton, f.o.b. Cartersville, Ga. Crude, 88 to 94 per cent, $23; ground (white) $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, not less than 98 per cent, $11@$11.25 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis. Business quiet; manufacturers not putting in much stock.

Chalk—Domestic, extra light, 5@6c. per lb.; light, 4½@5½c.; heavy, 4@5c; English, extra light, 5@7c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $9@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground.

$15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$60, f.o.b. New York.

Feldspar—Crude, $8@$18 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $25@$30 car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $27.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Tonuco, N. M.

Graphite—Crucible flake, 85 per cent carbon content, 8c. per lb.; 88 per cent, 9½c.; 90 per cent, 10½c., all f.o.b. New York. Crucible grades of Alabama graphite sell as follows, f.o.b. Ashland, Ala.: 80 per cent, 5c.; 90 per cent, 10c. Lubricating grades in increasing demand, with price ranging from 11c. for the 85 per cent guaranteed grade in car lots to 30 and 40c. for higher grades. Mexican, amorphous, $45@$55 per short ton; Korean, 3½c. per lb.; Madagascar, 8c.; Ceylon, 4½@15½c.

Gypsum—Raw crushed rock, $3.50@$4 per ton; raw ground fine, $4@$4.50; calcined stucco, $9, all f.o.b. works. Containers extra. The last price quoted for plaster of paris in carload lots was $4.25 per 250-lb. bbl., f.o.b. mill, alongside dock, New York.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. Freshly ground calcined, suitable for flooring trade, $75@$85 per ton, f.o.b. Eastern points.

Dead-Burned — $32.50 per net ton, Chewelah, Wash.; $52@$58, Chester, Pa. Austrian grade, $52@$55 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20@$1.40; No. 4, $2@$3; No. 3, $4.25@$5; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $2; No. 4, $4; No. 3, $5.75; No. 2, $7; No. 1, $9; A1, $14; extra large, $25, all f.o.b. New York; ground, $100@$150 per ton, Philadelphia. Domestic, uncut f.o.b. Franklin, N. C., as follows: Scrap, $45@$50 per ton; punch, 4@5c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., $1.15; 2 x 3 in., $1.65; 3 x 3 in., $2.10; 3 x 4 in., $2.50; 3 x 5 in., $2.75; 3 x 6 in., $3.75; ground 165 mesh, $240 per ton; ground roofing mica, $60; mica washers, 75c.@$2 per lb.; 1½-in. disks, No. 1, $1.60 per lb.; No. 2, $1.30.

[1]Monazite — Minimum of 6 per cent thorium oxide, $35 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. There is no price schedule for spot for domestic uses.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 17c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1½ to 2 in., $14; rice, $17, all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines. F.o.b. Wausau, Wis., the price is $16 per ton in car lots, and $22 less quantities, including bags.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand or Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4.

Sulphur—$18 per ton for domestic; $20 for export, f.o.b. Texas and Louisiana mines.

Talc — Paper making, $10@$20 per ton; roofing grades, $9@$15; rubber grades, $10@$15, all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $60@$70; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 15½c. per lb.; sulphide, powdered, 20@21c. per lb., f.o.b. works, carload lots.

Nitrate—Soda, $3.85 per cwt., ex vessel, Atlantic ports. Market quiet.

Potassium Sulphate—Domestic, $2.25@$2.50 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$250 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15. Foreign conditions as affecting the price of American goods remain unchanged.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 17@18c. per lb. of chromium contained; 4 to 6 per cent carbon, 19@20c. f.o.b. works.

Ferromanganese—For 76 to 80 per cent, prompt delivery, $200, freight allowed; last half, $170; English, $170@$175, c.i.f. Atlantic seaports. Spiegeleisen, 18@22 per cent, $80@$85, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50@$3 per lb. of contained metal, f.o.b. works.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $60@$65; 50 per cent, $82.50@$85; 75 per cent, $150@$160.

Ferrotungsten—70 to 80 per cent W, $1.10@$1.15 per lb. of contained tungsten, f.o.b. works.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $6.50@$9.50 per lb. of V contained, f.o.b. works.

Metal Products

Copper Sheets — Current New York price, 29½c. per lb.; wire quoted, 22½@23c.

Lead Sheets—Full lead sheets, 11c.; cut lead sheets, 12½c. in quantity, mill lots.

Nickel Silver—Unchanged at 39½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 26¾c.; sheathing, 25¾c.; rods, ⅜ to 3 in., 23¾c.

Zinc Sheets—$12.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 12c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Brick—$100@$110 per net ton, carload lots, eastern points.

Chrome Cement—40 to 45 per cent Cr_2O_3, $50 per net ton, and $55 in sacks, carload lots, eastern shipping points.

Clay Brick — First-quality fire clay, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio, and Kentucky works; second quality, $50@$55. First quality, St. Louis, $45; New Jersey, $75.

Magnesite Brick—$110@$120 per ton, eastern shipping points; 9-in. straights, $90@$100; 9-in. arches, wedges and keys, $95@$105; soaps and splits, $110@$120.

Silica Brick—9-in., per 1,000, $56@$61, Birmingham, Ala.; $55@$60, Mount Union, Pa.; $65, Chicago district.

Iron Trade Review

Pittsburgh, Sept. 14, 1920

Pig Iron—The deadlock in pig iron is clearly marked, consumers being content with present commitments and regarding prices as at their peak. From July to August production of merchant pig iron increased 6 or 7 per cent, and further increases are to be expected, though consumption seems clearly to be declining. The refusal of Chicago and Birmingham district furnacemen to follow the recent advances in other markets is considered significant. We quote the Valley market unchanged at $50 for foundry and, malleable and $48.50 for bessemer and basic, freight to Pittsburgh being $1.96.

Steel—Billets remain stagnant, with the $60 quotation almost nominal. Sheet bars are quotable at $67.50@$70 on the basis of last sales, with demand light. Forging billets are down to $75.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls.; hardwood, 6c. per lb., in 250-lb. bbls.

Connellsville — Furnace, $17@$18; foundry, $18@$20.

Europe's Zinc Activities

Both London and United States Markets Dull—Germany Entering the Market, Great Britain's Industry Partly Closed, and Belgium Strenuously Attempting To Regain Her Important Pre-War Position

THE zinc market is still in the same inactive condition that has characterized it for many weeks. Quotations do not vary widely, and the average price for August, 8.185c. per lb., New York, showed but a small gain over the July average of 8.070c. The June average, 7.815c., was the lowest recorded so far this year, and although it would appear that the market has been given an upward impetus, a tendency is exhibited at present to lose a part of the gain made, mainly owing to the depressing influence of the London market.

In pre-war years the United States was accustomed to be content with a mediocre foreign trade in zinc, for domestic consumption almost balanced domestic zinc production. The war seriously disturbed this relation, and there is a desire on the part of the industry to retain the support and beneficent effect of the foreign market; but little if any success has attended the efforts of the industry, since the armistice, to become a factor of major importance in the foreign market, a circumstance that has been due to the evident present inability of Europe to consume large quantities of spelter. Plentiful supplies of European and American zinc seem to be available in the London market. In fact, with the present condition of the United States and London markets, foreign zinc (mainly of American origin) is freely offered here. Not only that, but German zinc is also being offered in London, and is the present contributory cause to the decline in zinc. Considering the greater post-war importance of the foreign market, any light on conditions in Europe, Australia, or other zinc-producing countries is especially valuable and suggestive.

German Zinc a Factor in the Market

Germany, so it is reported, has raised the allowable percentage of zinc production which can be exported, from a former maximum of 25 per cent to a maximum of September-October production of 50 per cent—a 100 per cent increase in allowable exports. The pressure to sell German zinc is an indication that the output of Germany is increasing, but the condition of the industry there is still uncertain. The political developments which will be disclosed by Silesia's vote in the plebiscite, soon to be taken, will do much to make Germany's future position in the zinc trade of the world apparent. It is clearly to Germany's advantage under present low foreign exchange to sell all zinc possible.

Belgium is endeavoring rapidly to regain her former importance in the zinc trade. The directors of the Société Anonyme des Mines et Fonderies de Zinc de la Vielle Montagne, the most important Belgian producers, recently gave an estimate of European zinc production during 1919 as 100,000 metric tons, against 680,000 tons in 1913, of which amounts Belgium produced over 200,000 tons in 1913 and but 18,000 tons in 1919, chiefly on account of dearth of raw materials. Production in 1919 should be close to 85,000 tons. The directors call attention to the fact that Japan greatly curtailed her zinc industry in 1919, which had been greatly stimulated in war time, and from other sources it is learned that Japanese production dropped 50 per cent, from 44,500 metric tons in 1918 to 10,000 metric tons in 1919, and that zinc exports decreased at an even greater rate, or from a value of 9,067,000 yen in 1918 to a value of 2,931,000 yen in 1919.

Belgium's Efforts at Reconstruction

During 1919 efforts were directed to the reorganization of the French and Belgian works of the Société Anonyme. In Belgium the foundries at Valentin-Cocq, Angleur, and Flone only partially resumed activity during the latter part of 1919. The works at Baelen-Wezel (Campine) have been almost exclusively engaged in repairing the destruction incident to the war. The rolling mills at Haumont are being rebuilt. Owing to the production of the company's own mines at Moresnet, and in England, Sweden, Algeria, Italy, and Sardinia, and stocks of raw materials at hand, the company was able to supply its reduction works with zinc ore after the armistice, but an acute fuel shortage interfered with operations.

Belgium is now having a trying time producing zinc with the London prices as they are. It is reported that the cost of production varies between £43 and £48 per ton. (Coal at 100 fr. per ton).

English Zinc Industry in a Parlous State

The zinc-smelting industry in England is still handicapped by labor troubles, which have compelled the industry to partly shut down. Some of the smaller plants are entirely closed. The London correspondent of the American Zinc Institute estimates the cost of zinc production in England at over £50 per ton, whereas the market is around £38 per ton. However, the explanation is vouchsafed that the London price is artificial, as 90 per cent of the zinc delivered against contracts is American, and with zinc in the United States at 8c. it cannot be laid down at less than £50 per ton. The forced liquidation of large stocks of speculative zinc and the large available supplies account for the low quotation.

The imports of refined and G. O. B. zinc into England during May, June, and July, in tons, are given as follows, by the London Metal Exchange:

From	July	June	May
U. S. A.	11,556	6,117	9,421
Belgium	148	409	966
Scandinavia	225	464	525
Rest of Europe	317	484	808
Canada	125	50	101
Other countries	319	1	84
Totals	12,690	7,525	11,905
Delivered from warehouse during July	1,299	946	923

Zinc stocks on hand in Great Britain on July 31 totaled 25,828 tons, compared with 26,828 tons on June 30 and 23,411 tons on May 31.

The absence of demand in London and the large liquidated stocks have induced dealers to offer metal on the Atlantic seaboard at the attractive prices of 7.70 to 7.80c., duty paid. Domestic producers cannot compete with such prices and must wait until surplus supplies are consumed before they can again enter the market. In many cases the freight rate from the Atlantic seaboard to interior consuming points is lower than the rate from East St. Louis; hence the advantage to the consumer of using reshipment imported zinc of American origin.

Latest Rand Gold Production

During July, the gold production of the Rand, in South Africa, amounted to 736,000 oz., an increase in output over the June figure, 715,957 oz. A table summarizing production since 1917 follows:

RAND GOLD OUTPUT 1917-1920

(Fine Ounces)

	1920	1919	1918	1917
January	670,503	676,059	714,182	782,634
February	625,330	636,728	659,750	721,321
March	707,036	712,379	696,281	787,094
April	686,979	694,944	717,099	742,778
May	699,041	724,995	741,217	729,385
June	715,957	702,379	727,696	759,724
July	736,000	725,497	736,199	757,890
August	.....	706,669	740,210	756,658
September	.....	698,553	708,206	738,231
October	.....	723,722	679,764	751,290
November	.....	677,970	658,701	722,839
December	.....	650,191	641,245	722,419

COMPANY REPORTS

Butte & Superior Mining Co. Resumes Normal Operation

Zinc; Montana

The following comparative statement shows the principal operating features of the Butte & Superior Mining Co. for the second quarter of 1920:

	Second Quarter, 1920	First Quarter, 1920
Dry tons of ore milled	81,619	130,204
Average zinc content (per cent)	13.339	14.164
Average silver content (oz. per ton)	5.340	5.530
Tons zinc concentrates produced	19,281	32,535
Average zinc in zinc concentrates (per cent)	52.774	53.859
Total zinc in zinc concentrates (lb.)	20,350,566	35,045,757
Average silver in zinc concentrates (oz. per ton)	19.429	19.499
Mill recovery (per cent zinc recovered in zinc concentrates)	93.457	95.018
Direct mining cost per ton	$7.000	$5.521
Direct milling cost per ton	$3.456	$2.610
Total direct cost mining and milling (per ton)	$10.456	$8.131
Indirect or general costs (per ton), exclusive of freight	$1.066	$0.497
Total costs (per ton)	$11.522	$8.628

The decrease in tonnage treated, with the resulting increase in costs, was due to the unsettled labor conditions during the entire quarter, which materially affected both mining and milling operations.

A strike called on April 19 resulted in a shutdown until May 5, when operations were resumed on a limited scale. Operations were being conducted on nearly a normal basis toward the end of the quarter.

The financial results for this quarter, as compared with the first quarter of 1920, are as follows:

	Second Quarter, 1920	First Quarter, 1920
Net value of zinc concentrates at mill	$587,957.25	$1,224,548.17
Net value of lead concentrates at mill and residual values	177,854.27	506,301.96
Miscellaneous	27,619.63	19,920.18
	$793,431.15	$1,750,770.31
Operating costs, depreciation, shutdown expense	940,432.97	1,123,514.36
Profit	(a) $147,001.82	$627,255.95

(a) Loss.

The above statement includes charges for depreciation and shutdown expenses, but no allowance has been made for depletion or taxes.

The average price used in estimating the income for the period was 7.6487c. per pound.

Mond Nickel Co., Ltd., Shows Comfortable Profits

The annual report of the Mond Nickel Co., Ltd., for 1919 says that sundry credits stood at £750,232, showing a decrease of over £250,000, which was chiefly accounted for by the settlement of the amounts due to the government for taxation. The profits of the company were subject to taxation in England and in Canada, and it was to be hoped that by the end of the current financial year this tax would be entirely withdrawn. The substantial amount of £97,230, of "Additions in the United Kingdom," was made up of additions to the refining works at Clydach, and also to the new rolling mill which the company had acquired in Birmingham.

Since the end of the financial year the company had completed the purchase of the whole of the shares of Messrs. Henry Wiggin & Co., of Birmingham—the oldest established firm of nickel and nickel-silver manufacturers in England. Messrs. Wiggin owned three works in Birmingham, well equipped with rolling mills, wire-drawing plant, refining plant, and other machinery for the manufacture of their various products. The shares and debentures in associated companies stood at £316,501, and investments at £116,592. There had been no change since the previous year's report in the former item, but investments showed a reduction of about £560,000, owing to the sale of war bonds.

Stocks showed an increase of over £100,000, as compared with those of 1918, at which time, as large stocks of nickel had accumulated in the hands of the government and at the company's works at the end of the war, it was necessary to curtail production. These stocks had been substantially reduced, so much so that the company had begun producing on a larger scale at the refinery. The increase in the present stock was due to the increase in the stock of matte, which, during the year, was produced at a larger rate than was warranted by the amount refined. This the directors decided to do to keep the organization together in Canada, and to have a reserve of matte for contingencies.

The balance brought forward from 1918 was £168,058, and the balance at credit of profit-and-loss account was £382,354, making a total of £550,412, less directors' fees of £19,117, leaving a balance for distribution of £531,294, as compared with £422,658 in 1918. The total amount of dividend proposed to be paid was £332,500. In addition to the dividends the directors had also had to provide out of the profits £84,000 for income tax, which was the result of the change introduced in the previous year, of paying the dividends on the ordinary shares free of tax. This made a total of £416,500, leaving a balance of £114,794 to be carried forward to next year's accounts.

Davis-Daly Copper Co.

Copper; Montana

The report of the Davis-Daly Copper Co. for the second quarter of 1920 shows that tonnage hoisted amounted to 17,414 tons, producing 2,197,936 lb. of copper and 91,238.5 oz. of silver. The average assay of ore shipped for the period was 7.07 per cent copper and 5.88 oz. of silver to the ton.

Cash and quick assets on June 30, 1920, amounted to $580,176.99.

Receipts and disbursements follow:

RECEIPTS

	Ore Returns	Misc. Revenues
April	$106,759.35	$26,702.68
May	64,616.40	14,197.51
June	78,086.46	20,671.64
Total receipts, $311,034.04.	$249,462.21	$61,571.83

DISBURSEMENTS

	Development	Mining Cost	Equipment	Butte Gen. Exp.	Boston Exp.
April	$11,869.38	$62,791.82	$5,189.26	$13,869.14	$10,802.82 (a)
May	11,977.65	51,576.38	4,242.89	13,537.19	6,254.74
June	21,528.64	74,993.62	5,830.20	19,859.77	10,711.73 (a)
	$45,375.67	$189,361.82	$15,262.35	$47,266.10	$27,769.29

Total disbursements, as above, $325,035.23.
(a) Including U. S. Income Tax.

Chief Consolidated Mining Co.

Silver-Lead; Utah

The report of the Chief Consolidated Mining Co. for the second quarter of 1920 shows that 2,919,902 lb. of lead was contained in the ore mined, together with 513,285.4 oz. of silver, 100,935 lb. of zinc, 1,032.184 oz. of gold, and 471 lb. of copper. The average per ton of all ores was $39.44. Smelting, freight, and sampling was $19.12 per ton, giving a net value of $20.32 per ton. A total of 20,071 dry tons of ore was mined.

The net profit after payment of all charges was $18,073.09. A dividend of 10c. per share on the 884,232 shares of outstanding stock of par value $1 was paid on May 1.

MINING STOCKS

Week Ended September 11, 1920

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston	...	...	*50	...	
Ahmeek	Boston	59½	57½	57½	June '20, Q	.50
Alaska-B.C.	N. Y. Curb	1	1	1	...	
Allouez	Boston	24½	24	24½	Mar. '19,	1.00
Anaconda	N. Y.	55⅜	53	53½	Aug. '20, Q	1.00
Ariz. Com'l	Boston	10½	10¼	10½	Oct. '18,	.50
Big Ledge	N. Y. Curb	...	...	⅛	...	
Bingham Mines	Boston	8½	8¼	8½	Sept. '19, Q	.25
Calumet & Ariz.	Boston	58	57	57	June '20, Q	1.00
Calumet & Hecla	Boston	300	285	290	June 20, Q	5.00
Canada Copper	N. Y. Curb	...	...	7/16	...	
Centennial	Boston	10½	10	10¼	Dec. '18, SA	1.00
Cerro de Pasco	N. Y.	44½	42½	43	June '20, Q	1.00
Chief Consol.	Boston Curb	3⅛	3⅛	3⅛	Feb. '20, Q	.10
Chile Copper	N. Y.	15⅜	14¼	15	...	
Chino	N. Y.	30⅛	29	29	June '20, Q	.37½
Columbus Rexall	Salt Lake	*39	*35½	*37	...	
Con. Ariz.	N. Y. Curb	¼	7/16	¼	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	...	...	2¼	...	
Copper Range	Boston	36½	35½	36	June '20, Q	.50
Crystal Copper	Boston Curb	*40	*35	*37	...	
Davis-Daly	Boston	8¼	8	8¼	Mar. '20, Q	.25
East Butte	Boston	11¼	10⅞	11¼	Dec. '19, A	.50
First Nat'l	Boston Curb	*90	*77	*90	Feb. '19, SA	.15
Franklin	Boston	2⅛	2½	2⅛	...	
Gadsden Copper	N. Y. Curb	...	...	*71	...	
Granby Consol.	N. Y.	37½	36	36	May '19, Q	1.25
Greene-Cananea	N. Y.	27¼	26⅜	26⅞	Aug. '20, Q	.50
Hancock	Boston	4	4	4	...	
Houghton	Boston Curb	...	...	*40	...	
Howe Sound	N. Y. Curb	...	...	3½	July '20, Q	.05
Inspiration Con.	N. Y.	48¾	47⅛	47⅞	July '20, Q	1.00
Iron Cap	Boston Curb	...	...	9	Feb. '19, M	.25
Isle Royale	Boston	29⅞	28	29½	Sept. '19, SA	.50
Kennecott	N. Y.	26⅞	25⅞	26	June '20, Q	.50
Keweenaw	Boston	...	...	1½	...	
Lake Copper	Boston	4	3½	4	...	
La Salle	Boston	2¾	2½	2½	...	
Magma Chief	N. Y. Curb	...	...	*21	...	
Magma Copper	N. Y. Curb	...	...	27½	Jan. '19, Q	.50
Majestic	Boston Curb	...	...	*13	...	
Mason Valley	Boston	1⅜	1⅛	1⅛	...	
Mass. Con.	Boston	3⅜	3	3⅛	Nov. '17, Q	1.00
Mayflower-O.C.	Boston	6⅜	6⅛	6⅛	...	
Miami	N. Y.	20¼	19¼	19¼	Aug. '20, Q	.50
Michigan	Boston	4¼	3⅛	3¼	...	
Mohawk	Boston	60½	59½	60	Aug. '20, Q	1.50
Mother Lode (new)	N. Y. Curb	...	...	5⅞	...	
Nevada Con.	N. Y.	11⅞	11¼	11½	June '20, Q	.25
New Arcadian	Boston	...	...	2½	...	
New Baltic	Boston Curb	...	...	3	...	
New Cornelia	Boston	18	17½	18	Aug. '20,	.25
Nixon Nev.	N. Y. Curb	...	...	*9	...	
North Butte	Boston	16⅞	16	16⅞	Oct. '18, Q	.25
North Lake	Boston	...	...	⅛	...	
Ohio Copper	N. Y. Curb	...	...	1/16	...	
Ojibway	Boston	...	...	1⅛	...	
Old Dominion	Boston	25⅜	24	25⅜	Dec. '18, Q	1.00
Osceola	Boston	39	38	39	June '20, Q	.50
Phelps Dodge	Open Mar.	†195	†180	...	July '20, Q	2.50
Quincy	Boston	48	45	48	Mar. '20, Q	1.00
Ray Con.	N. Y.	16½	15⅞	16	June '20, Q	.25
Ray Hercules	Boston Curb	...	...	*63	...	
St. Mary's M. L.	Boston	41½	40	41½	June '20, K	2.00
Seneca	Boston	15	14⅞	14⅞	...	
Shannon	Boston	1⅜	1¼	1⅜	Nov. '17, Q	.25
Shattuck Ariz.	N. Y.	8¾	8½	8⅝	Jan. '20,	.25
South Lake	Boston	...	...	2	...	
South Utah	Boston	...	...	*15	...	
Superior	Boston	5	4⅜	4⅜	Apr. '17,	1.00
Superior & Boston	Boston	4½	4	4¼	...	
Tenn. C. & C.	N. Y.	10	9¼	9⅞	May '18, I	1.00
Tuolumne	Boston	*60	*60	*60	May '13,	.10
United Verde Ex.	Boston Curb	31	30½	30½	Aug. '20, Q	.50
Utah Con.	Boston	8	6⅞	8	Sept. '18,	.25
Utah Copper	N. Y.	66⅜	63⅜	64½	June '20, Q	1.50
Utah M. & T.	Boston	1⅜	1¼	1 1/16	Dec. '17,	.30
Victoria	Boston	...	...	1⅛	...	
Winona	Boston	*50	*35	*50	...	
Wolverine	Boston	14⅛	13¾	13¾	Jan. '20, Q	.50
LEAD						
Hecla	N. Y. Curb	4½	4⅛	4¼	June '20, QX	.20
St. Joseph Lead	N. Y.	17¼	16	16	June '20, QX	.50
Stewart	Boston Curb	...	...	*16	Dec. '15,	.05
Utah Apex	Boston	...	...	1⅛	Nov. '18,	.25
ZINC						
Am. Z. L. & S.	N. Y.	13⅛	12⅝	12⅝	May '17,	1.00
Am. Z. L. & S. pf.	N. Y.	46⅜	44	46⅜	Aug. '20, Q	1.50
Butte C. & Z.	N. Y.	8⅛	7⅞	7⅛	June 18, I	.50
Butte & Superior	N. Y.	20	19	19	Sept. '17,	1.25
Con. Interst. Cal.	N. Y.	10⅞	10⅛	10⅛	June '20, Q	.50
New Jersey Z.	N. Y. Curb	181	178	178½	Aug. '20, Q	4.00
Success	N. Y. Curb	*5	*3½	*4½	July '16,	.03
Yellow Pine	Los Angeles	...	...	*95	June '20, Q	.03
GOLD						
Alaska Gold	N. Y.	1⅜	1¼	1¼	...	
Alaska Juneau	N. Y.	1⅛	1⅛	1	...	
Carson Hill	N. Y. Curb	...	...	24¾	...	
Cresson Consol. G.	N. Y. Curb	...	...	¾	June '20, Q	.10
Dome Ex.	Toronto	*38	*37	*38	...	
Dome Mines	N. Y.	11½	11¼	11½	July '20, Q	.25
Golden Cycle	Colo. Sprgs.	‡...	...	*73	May '20, Q	.02
Goldfield Con.	N. Y. Curb	*10	*8½	*9	Dec. '19,	.05
Hedley	Boston	...	...	4½	June '19,	.10
Hollinger Con.	Toronto	5.85	5.75	5.79	Aug. '20, BM	.05
Homestake	N. Y.	49	49	49	Sept. '19,	.50
Kirkland Lake	Toronto	*53	*51	*51	...	
Lake Shore	Toronto	1.13	1.10	1.10	Oct. '19,	.02½
McIntyre-Porcupine	Toronto	2.01	1.94	1.97	May '20, K	.05
Porcupine Crown	Toronto	...	...	*26½	July '17,	.03
Portland	Colo. Sprgs.	‡...	...	*60	July '20, Q	.01½
Reorgan. Booth	N. Y. Curb	5	4	5	May '19,	.05
Silver Pick	N. Y. Curb	*7	*5	*6	...	
Teck Hughes	Toronto	*9	*9	*9	...	
Tom Reed	Los Angeles	1.09	1.02	1.02	Dec. '19,	.02
United Eastern	N. Y. Curb	2 1/16	2¼	2¼	Apr. '20, Q	.21
Vindicator Consol.	Colo. Sprgs.	‡...	...	*18	Jan. '20, Q	.01
West Dome Consol.	Toronto	...	...	*6½	...	
White Caps Min.	N. Y. Curb	*9	*7½	*8	...	
Yukon Gold	Boston Curb	...	...	1½	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*19	*15	*18	Apr. '20, M	.03
Beaver Con.	Toronto	*43	*41	*41	May '20, K	.03
Coniagas	Toronto	...	...	2.55	Aug. '20, Q	.12½
Crown Reserve	Toronto	*29	*26½	*25½	Jan. '17,	.05
Kerr Lake	Boston	3	3	3	Sept. '19,	1.00
La Rose	Toronto	*35	*33	*33	Apr. '18,	.02
McKinley-Dar.	N. Y. Curb	...	...	*55	July '20, Q	.03
Mining Corp.	Toronto	1.70	1.65	1.65	June '20, Q	.12½
Nipissing	N. Y. Curb	10	9¾	10	July '20, Q	.25
Ontario Silver	N. Y.	5⅜	5⅛	5⅜	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	⅜	⅜	⅜	Jan. '12,	.10
Peterson Lake	Toronto	*14¾	*14	*14¾	Jan. '17,	.01½
Temiskaming	Toronto	*35	*33	*34	Jan. '20, K	.04
Trethewey	Toronto	*26	*25	*25½	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*2	*1½	*1½	...	
Barnes-King	Butte	‡...	...	1.11	Aug. '20, Q	.05
Bost. & Mont.	Boston	...	...	*63	...	
Cashboy	N. Y. Curb	*8½	*7	*8	...	
El Salvador	N. Y. Curb	1⅝	1⅜	1⅜	...	
Jim Butler	N. Y. Curb	*16	*14	*15	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*5⅛	*4	*5⅛	June '16,	.05
Louisiana Con.	N. Y. Curb	⅜	⅜	⅜	...	
MacNamara M.	N. Y. Curb	...	...	¼	May '10,	.02½
N.Y. Hond. Rosar	Open Mar.	†12½	†10½	...	July '20, QX	.50
Tonopah-Belmont	N. Y. Curb	1 1/16	1 1/16	1⅜	Jan. '20, Q	.05
Tonopah-Divide	N. Y. Curb	1 1/16	1 1/16	1⅞	...	
Tonopah Ex.	N. Y. Curb	1¼	1⅛	1⅛	July '20, Q	.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1 1/16	Oct. '19, SA	.15
West End Con.	N. Y. Curb	1⅛	1⅛	1 1/16	Dec. '19 SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	...	...	*20	July, '20, M	.01
Consol. M. & S.	Montreal	26	25	25⅜	July '20, Q	.62½
Daly Mining	Salt Lake	...	...	2.50	July '20, Q	.10
Daly-West	Boston	4⅜	4	4⅜	July '20, Q	.25
Eagle & Blue Bell	Boston Curb	2 1/16	2 1/16	2 1/16	Apr. '20, Q	.10
Electric Point	Spokane	...	...	*30	May '20, SA	.03
Fed. M. & S.	N. Y.	11	11	11	Jan. '09,	1.50
Fed. M. & S. pf.	N. Y.	33	33	33	June, '20, Q	1.75
Florence Silver	Spokane	*35	*33	*35	Apr. '19,	.01½
Grand Central	Salt Lake	...	...	*37½	June '20, K	03
Iron Blossom	N. Y. Curb	1/16	¼	1/16	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	...	...	3.97½	July '20, Q	.12½
Marsh Mines	N. Y. Curb	*17	*16	*17	...	
Prince Consol.	N. Y. Curb	⅜	1/16	⅜	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*13	*12	*13	Feb. '19,	.01
Rex Con.	N. Y. Curb	...	...	*6	...	
South Hecla	Salt Lake	*93	*93	*93	Sept. '19, K	.15
Stand. S. L.	N. Y. Curb	¼	¼	¼	Oct. '17,	.05
Tamarack-Custer	Spokane	2.35	2.25	2.35	Dec. '19, K	.03
Tintic Standard	Salt Lake	3.32½	3.20	3.25	June '20, Q	.10
Wilbert	N. Y. Curb	*4	*3	*4	Nov. '17,	.01
NICKEL-COPPER						
Internat'l Nickel	N. Y.	20	19½	19½	Mar. '19,	.50
Internat'l Nick.pf.	N. Y.	...	...	80¾	Aug. '20, Q	1.50
QUICKSILVER						
New Idria	Boston	5	5	5	Jan. '19,	.25
TUNGSTEN						
Mojave Tungsten	Boston Curb	...	...	*10	...	
VANADIUM						
Vanadium Corp.	N. Y.	71⅛	67½	67¾	July '20, Q	1.50
ASBESTOS						
Asbestos Corp.	Montreal	90	85	90	July '20, Q	1.50
Asbestos Corp. pf.	Montreal	100	97	100	July '20, Q	1.75
MINING, SMELTING AND REFINING						
Am. S. & R.	N. Y.	61½	59½	60	June '20, Q	1.00
Am. S. & R.pf.	N. Y.	92	91½	92	June '20, Q	1.75
Am. Sm. pf.A	N. Y.	72	72	72	July '20, Q	1.50
U. S. Sm. R. & M.	N. Y.	59	58½	58½	July '20, Q	1.50
U.S.S.R.& M. pf.	Boston	44½	43¼	43¼	July '20, Q	.87½

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly.
SA, Semi-annually. BM, bimonthly. K, Irregular. I, Initial. X, includes extra

CURRENT PRICES OF MATERIALS AND SUPPLIES

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
No. 10	$3.55–7.00	7.09	7.02	8.25	$7.12–8.00	4.57
No. 12	3.60–7.05	7.09	7.07	8.30	7.17–8.05	4.57
No. 14	3.65–7.10	7.09	7.12	8.35	7.22–8.10	4.67
No. 16	3.75–6.20	7.09	7.17	8.45	7.32–8.20	4.77
Black:						
*Nos. 18 and 20	4.15–8.30	8.10	8.00	10.60	8.30–9.80	5.30
*Nos. 22 and 24	4.20–8.35	8.10	8.05	10.65	8.35–9.85	5.35
*No 26	4.25–8.40	8.10	8.10	10.70	8.40–9.90	5.40
*No. 28	4.35–8.50	8.10	8.20	10.80	8.50–10.00	5.50
Galvanized:						
No. 10	4.70–8.00	9.60	8.50	....	8.80–11.00	6.20
No. 12	4.80–8.10	9.60	8.60	10.10	8.90–11.00	6.25
No. 14	4.80–8.10	9.60	8.60	10.10	8.90–11.10	6.30
Nos. 18 and 20	5.10–8.40	9.60	8.90	10.40	9.15–11.40	6.60
Nos. 22 and 24	5.25–8.55	9.60	9.05	10.55	9.30–11.55	6.75
*No. 26	5.40–8.70	9.60	9.20	10.70	9.45–11.70	6.90
*No. 28	5.70–9.00	9.60	9.50	11.00	9.75–12.00	7.20

* For painted corrugated sheets, add 30c. per 1000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets, add 15c., all gages.

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, ⅝ in. and larger	$4.00	$3.35	$3.55–$4.25	$5.34	$7.75
Track bolts	6.00–6.50	4.45	4.00–5.25	7.00	8.75
Standard section angle bars	3.00–4.00	3.00	2.75	2.00	5.30

STRUCTURAL MATERIAL—The following are the base prices f.o.b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the $2.55 places named:

	Mill Pittsburgh	New York Current	New York 1 Year Ago	St. Louis	Chicago
Beams, 3 to 15 in.	$2.45@$3.10	$4.58	$3.47	$4.04	$3.97
Channels, 3 to 15 in.	2.45@ 3.10	4.58	3.47	4.04	3.97
Angles, 3 to 6 in., ¼ in. thick.	2.45@ 3.10	4.58	3.47	4.04	3.97
Tees, 3 in. and larger	2.45@ 3.75	4.63	3.52	4.09	4.02
Plates	2.65@ 4.00	4.78	3.67	4.24	4.17

STEEL SHEET PILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$4.00@$5.00	$2.55@$3.65	$2.25

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Warehouse Mill Pittsburgh	New York Current	New York One Yr. Ago	Chicago	St. Louis	San Francisco
¾ in. and larger	$4.50	$6.00	$4.72	$5.62	$5.69	$7.05
CONE HEAD BOILER						
¾ in. and larger	4.60	7.10	4.82	5.72	5.79	7.15
⅝ and ⅞	4.75	7.25	4.97	5.87	5.94	7.40
½ and 9/16	5.00	7.00	5.32	6.22	6.19	7.60

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Hercules red strand, all constructions	20%
Patent flattened strand special and cast steel	20%
Patent flattened strand iron rope	5%
Plow steel round strand rope	30%
Special steel round strand rope	30%
Cast steel round strand rope	22½%
Iron strand and iron tiller	5%
Galvanized iron rigging and guy rope	+12%

San Francisco: Galvanized, iron rigging and guy ropes, +17½%; bright plow, 25% off.
Chicago, +12½% on galvanized, 30% off on bright.

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Denver	Chicago	St. Louis	Birmingham
Straight	$5.75	$8.15	$7.00	$7.00	$7.00
Assorted	5.85	8.40	7.15	7.15	7.25

BAR IRON AND STEEL—Per 100 lb. to large buyers at mill, Pittsburgh:
Iron bars..... $2.35@$4.00 Steel bars..... $4.27@$4.50

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Chicago	Denver
$0.10	$0.16½	$0.18	$0.11½	$0.15	$0.18

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham	Denver
Solid	12@14c.	13c.	15c.	14½ 21c.
Hollow	18c.	...	...	

STEEL AND IRON—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920:

BUTT WELD

Inches	Black	Galv.	Inches	Black	Galv.
¼ to 3	57½@54	44@41½	¼ to 1¼	34½@24½	18½@ 8
			2 and 2½	33½	17½
LAP WELD					
2	50½@47	38@34½	2	28½@20½	14½@ 6½
2½ to 6	53½@50	41@37½	2½ to 6	30½@22½	17½@ 9½
7 to 12	50½@47	37@33½	7 to 12	27½@19½	14½@ 6½
13 and 14	41 @37½	.....			
15	38 @35	.....			
BUTT-WELD, EXTRA STRONG, PLAIN ENDS					
¼ to 1¼	55½@52	39½	¼ to 1¼	34½@24½	19½@ 9½
2 to 3	56½@53	44@40½	2 and 2½	34½@24½	19½@ 9½
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	48½@45	37@33½	2	29½@21½	16½@ 8½
2½ to 4	51½@48	40@36½	2½ to 4	31½@23½	19½@11½
4½ to 6	50½@47	39@35½	4½ to 6	30½@22½	18½@10½
7 to 8	46½@43	33@29½	7 to 8	22½@14½	10½@ 2½
9 to 12	41½@38	28@24½	9 to 12	17½@ 9½	5½@ 5½

From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Cleveland	Black Chicago
⅜ to 3 in. butt welded	40%	40%	40@54%
3½ to 6 in. lap welded	35%	42%	40@50%
	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
⅜ to 3 in. butt welded	24%	31%	30 @40½%
3½ to 6 in. lap welded	20%	27%	27½@37½%

Malleable fittings, Class B and C, from New York stock sell at list plus 23%. Cast iron, standard sizes, net.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	+$6.00	$3.25	$0.75	$1.90	$0.50	$1.05
Hot pressed hexagon	+ 6.00	2.70	.75	1.90	.50	.85
Cold punched square	+ 6.00	3.25	.75	1.90	.50	1.00
Cold punched hexagon	+ 6.00	2.70	.75	1.90	.50	1.00

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50–10%
Chicago	50%	50%
Cleveland	50%	60–10–10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
⅜ by 4 in. and smaller	+20%	20%	20%
Larger and longer up to 1 in. by 30 in.	+20%	20%	20%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... List Cleveland..... $2.50 Chicago..... $3.00
For cast-iron washers the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $4.75

CONSTRUCTION MATERIALS

PREPARED ROOFING—Standard grade rubbered surface, complete with nails and cement, costs per square as follows at manufacturing points:

	New York 1-Ply c.l.	New York 2-Ply l.c.l.	New York 3-Ply c.l.	Philadelphia 1-Ply c.l.	Philadelphia 2-Ply l.c.l.	Philadelphia 3-Ply c.l.
No. 1 grade	$2.50	$3.00	$3.55	$2.40	$2.90	$3.45
No. 2 grade	2.25	2.70	3.20	2.15	2.00	3.10

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $4.25 per roll in carload lots and $4.50 for smaller quantities.

Shingles, red and green slate finish, cost $8.75 per square in carloads; $9.00 in smaller quantities, in Philadelphia.

ROOFING MATERIALS—Prices per ton f.o.b. New York and Chicago:

Tar felt (14 lb. per square of 100 sq.ft.), per roll	$3.50
Tar pitch (in 400-lb. bbl.), per 100 lb.	2.00
Asphalt pitch (in barrels), per ton	54.50
Asphalt felt (light), per ton	123.00
Asphalt felt (heavy), per ton	127.00

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
Minneapolis	$0.1152	$0.2016	$0.3168
Seattle	.09	.175	.30
Los Angeles	.10	.175	.....
New Orleans	.23	.28	.30
Cincinnati	.125	.2186	.8286

LUMBER—Price per M in carload lots:

	8 x 8-In. x 20-Ft. and Under				12 x 12-in. 20 Ft. and Under	
	P.	Fir	Hemlock	Spruce	P.	Fir
Boston	$73.00	$70.00	.....	$65.00	$85.00	$75.00
Kansas City	51.00	51.25	$51.25	51.25	60.00	51.25
Seattle	.....	34.00	.....	.....	.....	35.00
New Orleans	47.00	.....	.....	.....	55.00	.....
Atlanta	62.50	64.50	66.00	76.00	79.50	82.00
Baltimore	80.00	.....	.....	.....	92 50	.....
Cincinnati	45.00	50.00	50.00	.....	55.00	55.00
Montreal	87.00	87.00	70.00	85.00	79.00*	110.00
Los Angeles†	.....	57.00	.....	.....	.....	59.00
Detroit	67.00	.....	.....	.....	79.00	79.00
Denver	.....	43.75	.....	.....	.....	44.75

	1-In. Rough, 10-In. x 16-Ft. and under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir	Hemlock	P.	Fir
Boston	$110.00	$102.00	$52.00	$105.00	.....
Kansas City	102.00	106.50	106.50	113.00	$112.75
Seattle	.....	37.50	.....	.....	38.50
New Orleans	.....	42.00	.....	46.50	.....
Atlanta	85.00	90.00	.....	77.50	87.50
Baltimore (box)	57.50@65	.....	.....	57.50@62.50	.....
Cincinnati	50.00	55.00	50.00	45.00	50.00
Montreal	80.00	80.00	70.00	85.00	85.00
Los Angeles	.....	58.00	.....	.....	.....
Detroit	50.00	.....	49.00	44.00	.....
Denver	.....	42.75	.....	.....	40.25

*Montreal—Up to 22 ft.; over which, $3.00 per M. increase up to 30 ft.

NAILS—the following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Denver	Chicago	San Francisco
Wire	$4.25	$6.00	$5.40	$4.45	$6.45
Cut	.....	.....	5.90	8@10	8.50

PORTLAND CEMENT—These prices are for barrels in carload lots, without bags.

	Current	One Month Ago	One Year Ago Without Bags
New York (delivered)	$4.25	$4.10	$2.30
Jersey City (delivered)	4.25	3.22	2.27
Boston	3.32	3.32	2.42
Chicago	2.35	2.15	2.00
Pittsburgh	2.42	2.20	2.05
Cleveland	2.71	2.42	2.32

NOTE—Charge for bags is generally 25c. each, $1 per bbl.

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 200-lb. Barrel	
	Finished	Common	Finished	Common
New York	$19.50	$18.50	$3.50*at plant	$3.30*
Kansas City	27.20	26.20	2.50	2.40
Chicago	.....	.....	2.40	1.75
St. Louis	25.00	21.00	.....	2.25
Boston	27.50	25.25	3.70†	3.40†
San Francisco	23.50	19.50	.....	2.25
Minneapolis	29.50	23.00	2.00†	1.85†
New Orleans	16.00	.....	2.35	.....

NOTE—Refund of $0.10 per barrel.
* 300-lb. barrels. †180-lb. barrels.

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	Year Ago	Current	Year Ago
Raw per barrel (5 bbl. lots)	$1.48	$2.15	$1.95	$2.53
5-gal. cans	1.51*	2.28	2.15	2.73

*To this *oil* price must be added the cost of the cans (returnable), which is $2.25 for a case of six.

WHITE AND RED LEADS—500-lb. lots sell as follows in cents per pound:

	Red				White	
	Current		One Year Ago		Current Dry and	1 Yr. Ago Dry and
	Dry	In Oil	Dry	In Oil	In Oil	In Oil
100-lb. kegs	15.50	17.00	13.00	14.50	15.50	13.00
25- and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. kegs	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

MINING AND MILLING SUPPLIES

HOSE—

	FIRE	50-Ft. Lengths
Underwriters' 2½ in.		$0.85 per ft.
Common, 2½-in.		30%

	AIR		
	First Grade	Second Grade	Third Grade
½-in. per ft.	$0.60	$0.40	$0.30

STEAM—DISCOUNTS FROM LIST

First grade..... 20% Second grade.... 30% Third grade..... 45%

LEATHER BELTING—Present discounts from fair quantities (½ doz. rolls):

Light Grade	Medium Grade	Heavy Grade
30%	25%	20%

RAWHIDE LACING—For cut, best grade, 25%, 2nd grade, 30%. For laces in sides, 79c. per sq.ft.; 2nd, 75c. For semi-tanned: cut, 20%; sides, 83c. per sq. ft.

MANILA ROPE—For rope smaller than ⅜-in. the price is ½ to $0.02 extra while for quantities amounting to less than 600 ft. there is an extra charge of $0.01. The number of feet per pound for the various sizes is as follows: ⅜-in., 8 ft., ½ in., 6; ⅝-in., 4½; 1-in., 1½-in., 2 ft. 10 in.; 1¼-in., 2 ft. 4 in. Following is price per pound for ⅜ in. and larger, in 1200-ft. coils:

Boston	$0.32½	Kansas City	$0.30½
New York	.29½	New Orleans	.28¾
Cincinnati	.27	Seattle	.28
Chicago	.27½	St. Louis	.26½
Minneapolis	.29	Denver	.30
San Francisco	.27		

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$1.00
Asbestos for high-pressure steam	1.70
Duck and rubber for piston packing	1.00
Flax, regular	1.20
Flax, waterproofed	1.70
Compressed asbestos sheet	.90
Wire insertion asbestos sheet	1.50
Rubber sheet	.50
Rubber sheet, wire insertion	.70
Rubber sheet, duck insertion	.50
Rubber sheet, cloth insertion	.30
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1.30
Asbestos wick, ½- and 1-lb. balls	.85

RAILWAY TIES—For fair size orders, the following prices per tie hold:

Material	7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
Chicago—Plain	$2.00	$2.25
Chicago—Creosoted	2.25	2.50
San Francisco—Douglas fir, green	1.35	.96
San Francisco—Douglas fir, creosoted	2.50	1.92

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0.80	No. 1	$0.60
No. 2	.90	No. 2	.70
No. 3	1.00	No. 3	.80
No. 4	1.25		

FLOTATION OILS—Prices of oils for flotation, in cents per gal. in bbls.:

	New York	Chicago In. Bbl.	Chicago Carloads
Pure steam-distilled pine oil, sp.gr. 0.93-0.94	$2.30	$1.90	$1.85
Pure destructively distilled pine oil	1.80	1.90	1.85
Pine tar oil, sp.gr. 1.025-1.035	.48	.43	.42
Crude turpentine, sp.gr. 0.900-0.970	2.00	1.76	1.73
Hardwood creosote, sp.gr. 0.96-0.99*	.35	.....	.....

*F.o.b. Cadillac, Mich.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	11.00–15.50	13.00	16.00	11.00–14.00
Colored mixed	7.00–10.50	9.00–12.00	12.00	9.50–12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13¼x13¼	13¾x13¾
Cleveland	$55.00	$65.00
Chicago	41.00	43.53

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing	Gelatin			Black
	20%	40%	60%	80%	Powder
New York	.....	$0.3125	$0.3425	.....	$2.30
Boston	.....	.28	.31	.34	2.40
Kansas City	$0.2475	.27	.30	.34	2.40
New Orleans	.2425	.2825	.3125	.38	2.40
Seattle	.18	.205	.225	.29¼	2.60
Chicago	.2175	.2525	.2975	.34	2.45
Minneapolis	.2067	.2476	.2782	.....	2.80
St. Louis	.23	.27	.30	.3425	2.20
Denver	.2175	.2575	.2825	.33	2.70
Los Angeles	.22	.27	.31	.....	2.95
Atlanta	.22	.245	.265	.....	2.55
Cincinnati	.2275	.2525	.2725	.....	2.30
Montreal	.30	.32	.37	.38	4.10

CHEMICALS

SODIUM CYANIDE—New York price is 25@30c. per lb.; Chicago, 30c.; St. Louis, 31c.; Birmingham, 45c.; Denver, 40c

SODIUM SULPHIDE—New York price per pound is 9c.@10c. for concentrated, Chicago, 5c. for concentrated, 3½c. for crystals. Denver price is 6c. for crystals. Concentrated comes in 500-lb. drums; crystals in 440-lb. bbl.

ZINC DUST—For 350 mesh the New York price is 11@12c. per lb.; Chicago 12½c.; St. Louis, 12c.

ALUMINUM DUST—Chicago price is $1.10 per lb.; Birmingham, $1.52.

MINERS' LAMP CARBIDE—Prices net f.o.b. cars at warehouse points:

	Union 100-Lb. Drums Per Ton	Cameo 100-Lb. Drums Per Ton	Union Single 25-Lb. Drums	Union 25-Lb. Ton Lots
East of the Mississippi, North of Chattanooga	$106.00	$101.00	$1.52	$1.49
Southeastern portion U. S. A.	115.50	110.50	1.63	1.60
Texas (except E. Paso)	124.00	119.00	1.74	1.71
El Paso, Texas	126.00	121.00	1.77	1.73
Denver, Col.	124.00	119.00	1.74	1.71
West Coast	129.00	124.00	1.81	1.77